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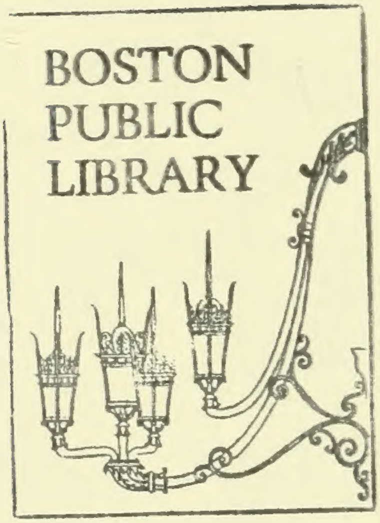

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THE CROSSTOWN BRIEFING BOOK

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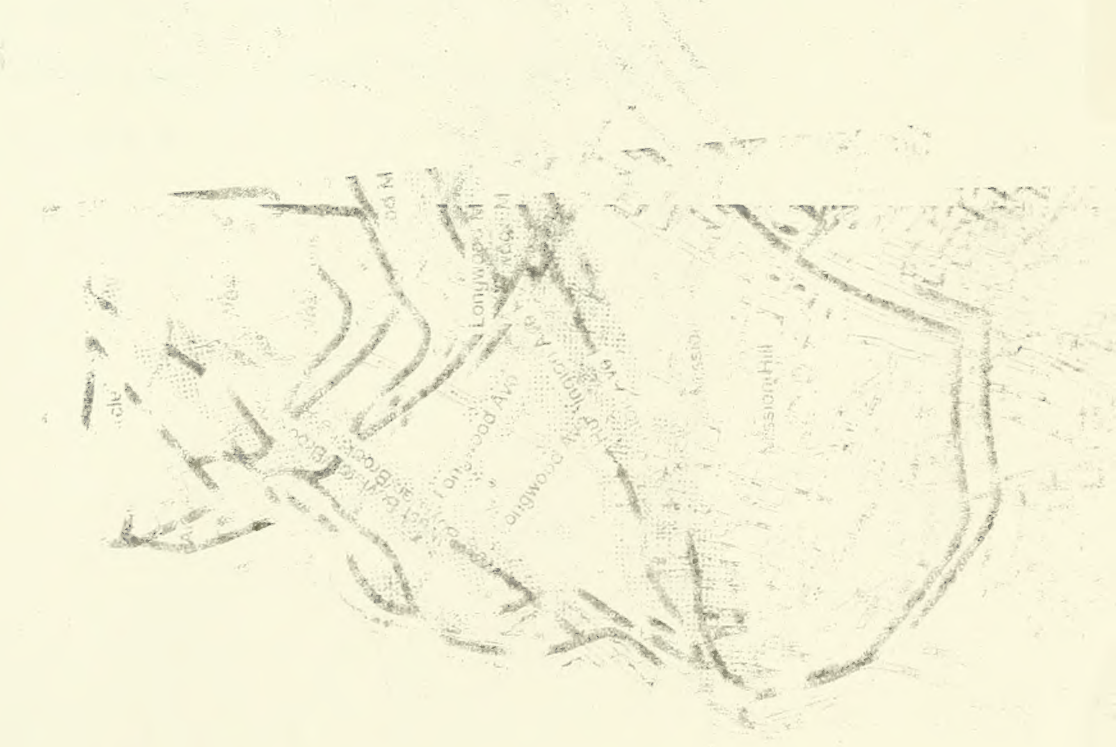
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Longwood Ave
Longwood Ave
Mission Hill

THE CROSSTOWN PLAN

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THE CROSSTOWN PLAN

A FRAMEWORK FOR DISCUSSION

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EXCERPTS FROM
A BRIEF SOCIO-ECONOMIC PROFILE
OF THE
MISSION HILL / LONGWOOD MEDICAL / FENWAY-KENMORE AREA

BRA RESEARCH DEPARTMENT

MAY 1985

I. SUMMARY AND INTRODUCTION

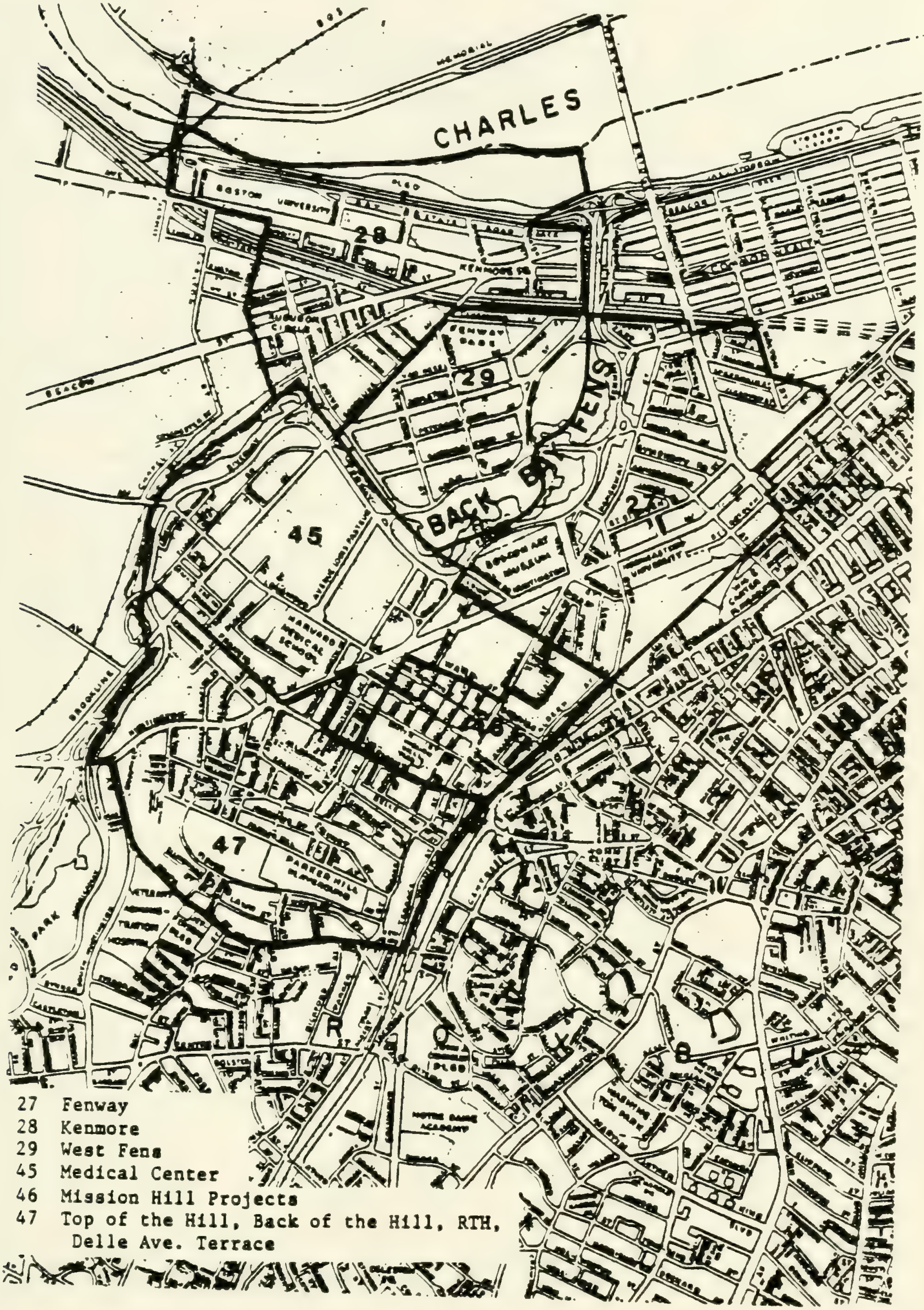
The character of the Mission Hill/Longwood Medical/Fenway-Kenmore area is shaped by large and numerous medical and educational institutions. As job sources, the institutions attract professional, technical and service workers, many of whom are residents or become residents of the area. As service providers, the institutions attract people from all over New England, the nation and far beyond national borders. Thousands of students come to colleges and universities in the Mission Hill/Longwood Medical/Fenway-Kenmore area and reside in the vicinity of those institutions.

The presence of these institutions is reflected in the population and labor force characteristics of the area. The population is young and relatively well-educated. Incomes are low and households are small compared to the City as a whole. The resident workers are more inclined to have professional/managerial/technical occupations than their counterparts in the rest of the City.

In terms of housing, renter-occupied units dominate the Mission Hill/Longwood Medical/Fenway-Kenmore area and most of the housing structures have five or more units. In the last five years, condominium conversions have been numerous in the area.

This demographic/economic profile uses two geographic definitions for the Mission Hill/Longwood Medical/Fenway-Kenmore areas. For population, labor force and housing, six neighborhood statistics areas form a reasonable study area: Fenway (27), Kenmore (28), West Fens (29), Medical Center (45), Mission Hill Projects (46),Top of the Hill-Back of the Hill-RTH-Delle Ave. Terrace (47), see Figure 1. For

Mission Hill/Longwood Medical/Fenway-Kenmore



27 Fenway
28 Kenmore
29 West Fens
45 Medical Center
46 Mission Hill Projects
47 Top of the Hill, Back of the Hill, RTH, Delle Ave. Terrace

business establishments and employment by place of work, the data are available by zip code only. Three zip codes (02115, 02215 and 02120, see Figure 2) cover the Mission Hill/Longwood Medical/Fenway-Kenmore area. The latter configuration covers more of the Fenway around Massachusetts Avenue than the combination of neighborhood areas. Otherwise, the two definitions are compatible and are treated as a single study area in the rest of this profile. Demographic data for the individual neighborhood areas are presented in the Appendix.

In addition, a condominium development summary relates to a compilation of census tracts (101.01, 101.02, 102, 103, 104, 808, 809 and 811) and a summary of development projects covers the Fenway-Kenmore planning district (#7) and selected streets in the Jamaica Plain planning district (#9).

II. DEMOGRAPHIC CHARACTERISTICS

Population

The Mission Hill/Longwood Medical/Fenway-Kenmore area (Neighborhood Statistics Areas 27, 28, 29, 45, 46 and 47) had a population of 41,905 in 1980 (see Table 1). The residents were 16 percent black, compared to 22 percent in the City of Boston. However, Asian and Pacific Islanders (4 percent of area total) and persons of Hispanic origin (9 percent) had higher relative representation in the area than in the City.

The residents of the area were young in 1980. Thirty-two percent of the population was 20 to 24 years of age and another 22 percent was 15 to 19 years of age. Citywide, persons in those two age brackets, combined, comprised only 24 percent of the total population. Evidently, a large student population lived near the numerous educational institutions (see Workplaces and Employment, below) in and near the area.

The Mission Hill/Longwood Medical/Fenway-Kenmore area had 15,595 households, most of which were small, nonfamily households (see Table 2). In fact, only 26 percent of the area's households were families, compared to 54 percent in the City, and the area had 1.8 persons per household, compared to 2.4 persons per household in Boston. More than half of all households in the area were comprised of only one person. The large number of persons who lived in group quarters (13,516 or 32 percent of all persons in the area) provides more evidence of a large student population.

Table 1

POPULATION CHARACTERISTICS
MISSION HILL/LONGWOOD MEDICAL/FENWAY-KENMORE AREA AND CITY OF BOSTON, 1980

Characteristics	Mission Hill/ Longwood Medical/ Fenway-Kenmore	City of Boston
Total persons	41,905	562,994
Percent of Boston	7.4%	100.0%
White	30,615	393,937
Percent of total persons	73.1%	70.0
Black	6,700	126,229
Percent of total persons	16.0%	22.4%
Asian and Pacific Islander	1,645	15,150
Percent of total persons	3.9%	2.7%
Spanish Origin	3,729	36,068
Percent of total persons	8.9%	6.4%
Persons 15 to 19 years of age	9,270	55,545
Percent of total persons	22%	10%
Persons 20 to 24 years	13,479	81,185
Percent of total persons	32%	14%
Persons 25 to 29 years	4,702	62,972
Percent of total persons	11%	11%
Persons 65 years and over	2,963	71,299
Percent of total persons	7%	13%

Source: U.S. Bureau of the Census, Neighborhood Statistics Program, 1980.

Table 2

HOUSEHOLDS
MISSION HILL/LONGWOOD MEDICAL/FENWAY-KENMORE AREA AND CITY OF BOSTON, 1980

Characteristics	Mission Hill/ Longwood Medical/ Fenway-Kenmore	City of Boston
Total persons in households	28,389	523,476
Percent of total persons	68%	93%
Persons in group quarters	13,516	39,518
Percent of total persons	32%	7%
Number of households	15,595	218,457
Percent of Boston	7%	100%
Family households	4,132	117,832
Percent of all households	26%	54%
Persons per households	1.8	2.4
1-person households	8,224	80,306
Percent of total households	53%	37%
2-person households	4,530	63,041
Percent of total households	29%	29%
3-person households	1,498	30,334
Percent of total households	9%	14%
4- or more person households	1,343	44,776
Percent of total households	9%	20%

Source: See Table 1.

Income

The Mission Hill/Longwood Medical/Fenway-Kenmore area had relatively low household and per capita income in 1979 (see Table 3). Again, the student population is reflected in the data. Only 27 percent of all households in the area earned over $15,000, while 42 percent of households in the City had incomes above that amount. Per capita income was $5,210 in the area, compared to $6,555 in the City. Furthermore, 29 percent of the area's families and 35 percent of all persons were below the poverty level. Certainly, not all of the low-income persons were students, especially in Mission Hill Projects (neighborhood number 46). However, many of the area's households were single students who worked part-time, if at all, and had low earnings.

Education

Residents of the Mission Hill/Longwood Medical/Fenway-Kenmore area were well-educated (see Table 4). Seventy-eight percent of the persons 25 years and older were high school graduates, compared to 68 percent in the City as a whole; and one-third had completed four or more years of college, in contrast to one-fifth in the City. In addition, a large portion of the younger adult residents of the area (20-24 years of age) were probably enrolled in local institutions of higher education.

Labor Force

Labor force participation in the Mission Hill/Longwood Medical/Fenway-Kenmore area (55 percent of persons 16 years and over) was somewhat less than in the City (60 percent) in 1980 (see Table 5), but the unemployment rate was relatively low (5.4 percent compared to 6.1

Table 3

INCOME
MISSION HILL/LONGWOOD MEDICAL/FENWAY-KENMORE AREA AND CITY OF BOSTON, 1980

Characteristics	Mission Hill/ Longwood Medical/ Fenway-Kenmore	City of Boston
Household income in 1979		
less than $15,000--number	11,387	125,659
percent	73%	59%
$15,000 to $34,999-number	3,565	74,985
percent	23%	34%
$35,000 and over---number	543	18,380
percent	4%	8%
Per capita income	$5,210	$6,555
Percent of families below poverty level	29%	17%
Percent of persons below poverty level	35%	20%

Source: See Table 1.

Table 4

EDUCATION
MISSION HILL/LONGWOOD MEDICAL/FENWAY-KENMORE AREA AND
CITY OF BOSTON, 1980

Characteristics	Mission Hill/ Longwood Medical/ Fenway-Kenmore	City of Boston
Persons 25 years old and over	15,940	330,650
Years of school completed		
4 years of high school	3,976	115,787
1 to 3 years of college	3,165	43,451
4 or more years of college	5,249	67,073
Percent of total	33%	20%
Percent high school graduates	78%	68%

Source: See Table 1.

Table 5

LABOR FORCE
MISSION HILL/LONGWOOD MEDICAL/FENWAY-KENMORE AREA AND
CITY OF BOSTON, 1980

Characteristics	Mission Hill/ Longwood Medical/ Fenway-Kenmore	City of Boston
Persons 16 years and over	38,416	459,249
Labor force	21,240	275,571
Percent of persons 16 and over	55%	60%
Civilian labor force	21,206	272,794
Employed	20,053	256,047
Unemployed	1,153	16,747
Percent of civilian labor force	5.4%	6.1%
Not in labor force	17,176	183,678
Female 16 years and over	19,297	246,877
Labor force	10,372	130,063
Percent of female 16 and over	54%	53%
Civilian labor force	10,369	129,975
Percent of total civilian labor force	49%	48%
Employed persons 16 and over	20,053	256,047
Managerial and professional occupations	5,753	66,660
Percent of employed persons	29%	26%
Technical, sales, administrative	7,683	87,796
Percent of employed persons	38%	34%
Service occupations	4,261	47,109
Percent of employed persons	21%	18%
Precision production, craft, repair	671	19,722
Percent of employed persons	3%	8%
Operators, fabricators, laborers	1,613	33,783
Percent of employed persons	8%	13%

Source: See Table 1.

percent in Boston). For the 20,053 employed persons 16 years and over, managerial, professional, technical, sales, administrative, and service occupations were somewhat more prevalent than for citywide workers. That mix of occupations was related to the industries in which people worked. Notably, 45 percent of the area's working residents were employed in professional and related services, including health care and education (see Table 6).

The means of transportation to work for the area's residents were primarily walking (39 percent) and public transportation (33%, see Table 7A). Only 25 percent traveled to work by car, truck or van, compared to 47 percent for residents of the City as a whole.

Walking to work was most prevalent in the Kenmore (28) and Medical Center (45) neighborhood areas. In fact, 61 percent of the workers living in the Medical Center area walked to work (see Table 7B). These data provide more evidence that workers in the medical and educational institutions tend to reside in the vicinity of their workplaces. Consequently, walking to work takes precedence over transit and, especially, work trips by automobile. If this relationship between workplaces and residents were altered, means of transportation to work and, subsequently, traffic patterns could change in the area.

Housing

Multi-unit, rental housing dominates the Mission Hill/Longwood Medical/Fenway-Kenmore area. Merely 4 percent of the area's units are owner-occupied, compared to 27 percent in the City as a whole (see Table 8). As for size, 84 percent of the area's housing units are in structures of 5 or more units, compared to 43 percent in all of Boston.

Table 6

OCCUPATION BY INDUSTRY
MISSION HILL/LONGWOOD MEDICAL/FENWAY-KENMORE AREA AND CITY OF BOSTON, 1980

Characteristics	Mission Hill/ Longwood Medical/ Fenway-Kenmore	City of Boston
Employed persons 16 years and over	20,053	256,047
Industry of Worker		
Construction	236	8,132
Percent of total	1%	3%
Manufacturing	1,938	36,521
Percent of total	10%	14%
Transportation	505	12,130
Percent of total	3%	5%
Communications/public utilities	199	6,552
Percent of total	1%	3%
Wholesale trade	438	7,096
Percent of total	2%	3%
Retail trade	3,535	36,041
Percent of total	18%	14%
Finance/insurance/real estate	1,166	23,079
Percent of total	6%	9%
Business and repair services	1,242	13,404
Percent of total	6%	5%
Personal and related services	1,042	10,696
Percent of total	5%	4%
Professional and related services	9,037	80,913
Percent of total	45%	31%
Health	3,323	35,075
Educational	4,142	27,989
Public administration	858	20,825
Percent of total	4%	8%

Source: See Table 1.

Table 7A

TRANSPORTATION TO WORK
MISSION HILL/LONGWOOD MEDICAL/FENWAY-KENMORE AREA AND CITY OF BOSTON, 1980

Characteristics	Mission Hill/ Longwood Medical/ Fenway-Kenmore	City of Boston
Workers 16 years and over	19,053	250,050
Means of transportation to work:		
Car, truck or van	4,664	118,356
Percent of total workers	24%	47%
Public transportation	6,508	84,211
Percent of total workers	34%	34%
Walked only	7,177	41,472
Percent of total workers	38%	17%

Source: See Table 1.

Table 7B

TRANSPORTATION TO WORK
MISSION HILL/LONGWOOD MEDICAL/FENWAY-KENMORE AREA AND
City of Boston, 1980

Characteristics	Fenway (27)	Kenmore (28)	West Fens (29)	Medical Center (45)	Mission Hill Projects (46)	Top of the Hill, Back of the Hill, RTH, Delle Ave. Ter. (47)
Workers 16 years and over	6,064	3,344	2,757	2,525	811	3,552
Means of transportation to work:						
Car, truck or van	1,461	469	602	466	378	1,288
Percent of total workers	24%	14%	22%	18%	47%	36%
Public transportation	2,224	1,234	1,153	445	230	1,222
Percent of total workers	37%	37%	42%	18%	28%	34%
Walked only	2,161	1,471	853	1,552	203	937
Percent of total workers	36%	44%	31%	61%	25%	26%

Source: See Table 1.

Table 8

HOUSING
MISSION HILL/LONGWOOD MEDICAL/FENWAY-KENMORE AREA AND CITY OF BOSTON, 1980

Characteristics	Mission Hill/ Longwood Medical/ Fenway-Kenmore	City of Boston
Total year-round housing units	18,109	241,304
Percent of Boston	8%	100%
Owner-occupied housing units	693	59,504
Percent of occupied units	4%	27%
Renter-occupied housing units	14,902	158,953
Percent of occupied units	96%	73%
Vacant housing units	2,514	22,847
Percent of year-round units	14%	10%
Year householder moved into unit (Renter-occupied housing units)		
1979 to March, 1980	6,791	51,200
Percent of all renter units	46%	32%
1975 to 1978	4,640	53,729
Percent of all renter units	31%	34%
Units in structure		
3 and 4	1,955	64,432
Percent of total units	11%	27%
5 or more	15,219	103,373
Percent of total units	84%	43%
Year structure built		
1939 or earlier	11,495	151,931
Percent of all units	63%	63%
1960 to March 1980	3,335	39,079
Percent of all units	18%	16%

Source: See Table 1.

Tenants in the renter-occupied housing units in 1980 were quite mobile: Forty-six percent of the householders moved into their units from 1979 to March 1980, in comparison to 32 percent citywide. This is consistent with the large number of college students in the area, most of whom move into the area to attend school.

The Mission Hill/Longwood Medical/Fenway-Kenmore area had a large stock of condominiums as of June 30, 1983. Sixty conversion cases produced 1,237 units, most of which were in the Fenway-Kenmore area (Bay State Road, Beacon Street, Commonwealth Avenue and Park Drive, see Table 9). Most of the development occurred after 1980.

III. WORKPLACES AND EMPLOYMENT

As of 1981, over one thousand private business establishments were located in the Mission Hill/Longwood Medical/Fenway-Kenmore area (zip codes 02115, 02215, and 02120). Those establishments employed over 48,000 workers, or 11 percent of Boston's private employees by place of work (see Table 10). The largest employers were mainly hospitals and universities (see Table 11); those with 500 or more employees accounted for 32,000 jobs in 1983. By type of business, services dominated the local economy, with 72 percent of the area's private employment (see Table 10). Retail trade (17 percent of total) was the only other substantial sector. In contrast, the City's economy was more diverse, with 39 percent of total employment in services, 16 percent in finance, 14 percent in retail trade and 13 percent in manufacturing.

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Fenway-Kenmore

Neighborhood Profile

1988

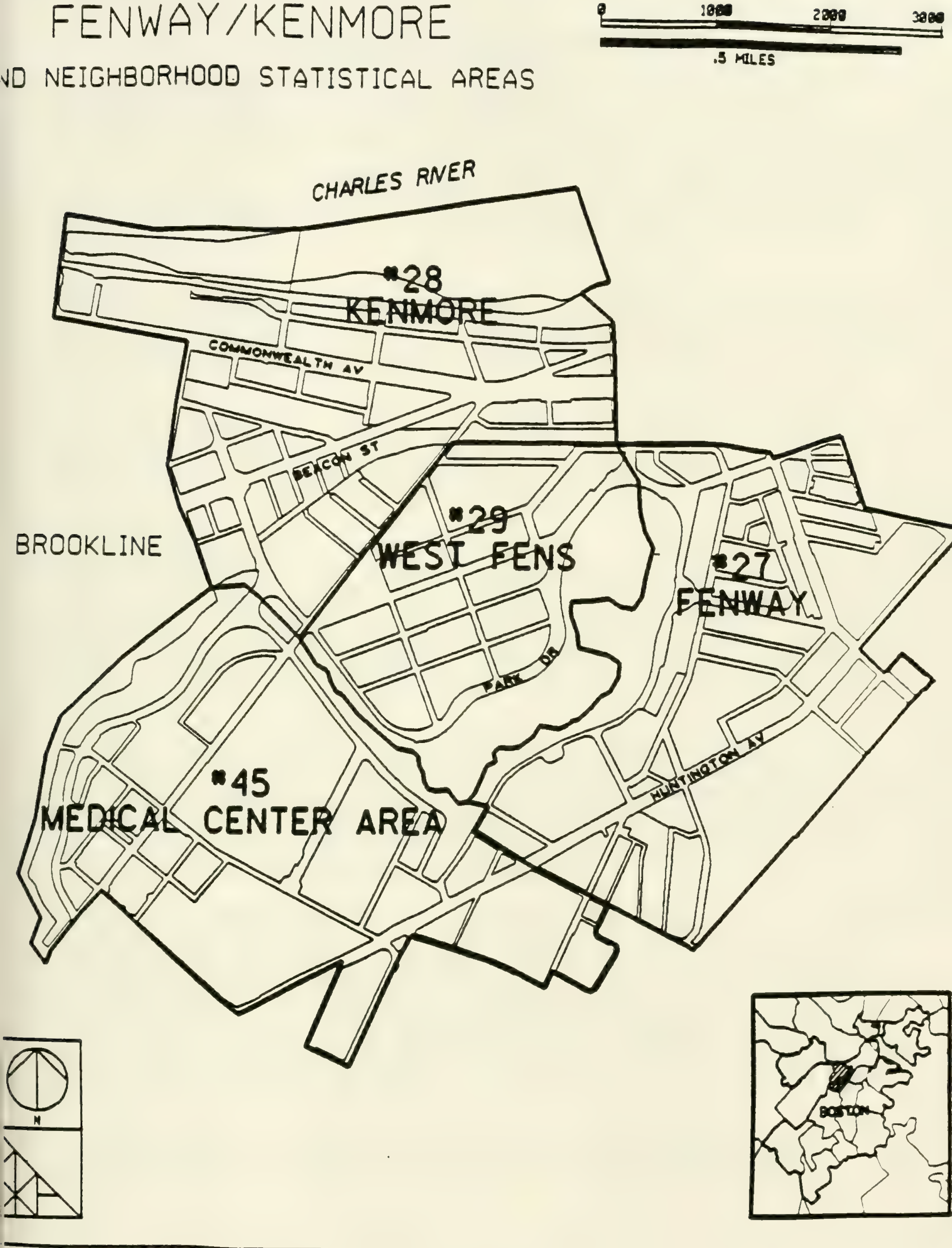
City of Boston
Raymond L. Flynn, Mayor

Boston Redevelopment Authority
Stephen Coyle, Director

Alexander Ganz, Assistant Director
Policy Development and Research

Boston Redevelopment Authority Board Members
Robert L. Farrell, Chairman
Joseph J. Walsh, Vice-Chairman
James K. Flaherty, Treasurer
Clarence Jones, Assistant Treasurer
Michael F. Donlan, Vice-Chairman
of Subcommittees
Kane Simonian, Secretary

PLANNING DISTRICT #7
FENWAY/KENMORE
ND NEIGHBORHOOD STATISTICAL AREAS



FENWAY/KENMORE NEIGHBORHOOD PROFILE

Introductory Overview

The Fenway was the last of Boston's neighborhoods constructed on filled land. Institutions, attracted by Olmsted's park in the Fens, began to locate in the area in the 1890s. The first of the area's institutions, the Christian Science Church, was constructed in 1894. The Massachusetts Historical Society, Symphony Hall, the Boston Medical Society, Horticultural Hall, the New England Conservatory, Simmons College, and the Isabella Stuart Gardner residence, now a museum, were constructed in the 1890s and early 1900s.

Today, many additional institutions including Boston University and Northeastern are located in the area. The first townhouses in the area were constructed in the Seven Streets area, between Massachusetts and Huntington avenues, and the Fens, simultaneously with institutional development. Apartment houses began to be constructed after World War I.

Fenway-Kenmore is unique among Boston's neighborhoods because of its concentration of college students and young adults. Residents are relatively well-educated, live in small, non-family households and have low incomes. About four out of ten residents live in college dormitories or other group quarters.

I. Neighborhood History

One century ago, the problems of the Fenway-Kenmore area, then referred to in city annals as "virtually an unusable asset," prompted the formation of the Boston Park Commission. The group was charged with both developing a park system for the city and solving the drainage difficulties of the Back Bay Fens, a notorious collector of sewage, swamp water, and flood runoff of nearby rivers. Not until Frederick Law Olmsted was called on to review the situation three years later were both objectives accomplished in a single scheme.

According to his recommendations, tidal gates for the Muddy River and Stony Brook were constructed, a sewage interceptor was buried in the Fens basin, and fill was placed around the conduit to create a public park. Olmsted's ingenious solution led to renewed residential and commercial development in Boston and enabled the westward expansion of the city. By 1920, the former mud flats along the Fens were filled completely with land, with the Fens dividing the Kenmore Square portion to the north and west and the Fenway part to the south and east.

Together with the park, two other factors were instrumental in the early development of the area: advances in mass transit and a major downtown fire. Horsecar lines, appearing around 1855, replacing the omnibus. Three decades later, electric cars further improved service. Through various linkages, Kenmore Square and lower Huntington Avenue became especially accessible by public transportation as well as by automobile on newly constructed streets and bridges. Meanwhile, the Boston Fire of 1872 led such institutions as the Massachusetts Historical Society, the Christian Science Church and the Boston Symphony Orchestra to settle near the Fens instead of the downtown in the late 1800s.

The Fenway-Kenmore area continued to attract and hold various institutions -- educational, cultural, medical and social -- of national and local importance. Nearby, apartment buildings were constructed early this century, joining the brownstone and

brick residences of the Symphony and Ruggles neighborhoods. These speculator-built apartment houses varied in quality of construction and, subsequently, in their maintenance. The slow deterioration typical of intown housing and commercial conditions during the late 1950s and early 1960s, together with the expansion needs of the Christian Science Church, led to the formation of a renewal plan by the Boston Redevelopment Authority in 1965.

Intending to rejuvenate the area through both large-scale reconstruction and improvements to existing neighborhoods and facilities, the Fenway Urban Renewal Project concentrated its initial activities in the vicinity of the Christian Science complex. Eventually its program erupted into a controversy between certain residents opposed to its plans for redevelopment, with a lawsuit in the early 1970s delaying new construction and project improvements, and providing for the formation of the Fenway Project Area Committee (FenPAC), a citizen advisory group.

Earlier, the portion of the district to the north and west of the Fens had experienced market development and decline in the century following Olmsted's improvements to the area. Kenmore Square had existed prior to the redesign of the Fens as an annex of the downtown characterized by fine hotels, shops and professional offices. Wealthy families moved into townhouses on Bay State Road around the turn of the century, and the Peterborough and Audubon Circle areas were built up with large apartment structures by speculative developers in ensuing decades.

Just south of the square, a light industrial and wholesale district flourished. The fibre of these sections has changed greatly in the past thirty years because of the dominance of Boston University and other colleges over the area, the placement of highway and railroad lines, a major sports facility (Fenway Park), and the change in locational preferences of offices and manufacturing facilities.

Table Ia. Population and Housing, 1950 - 1980

	1950	1960	1970	1980
Population	36,649 (4.6)	32,963 (4.7)	32,965 (5.1)	30,842 (5.5)
Housing units	13,082 (5.9)	15,049 (6.3)	13,243 (5.7)	12,468 (5.2)
Persons/unit	2.8	2.2	2.5	2.5

Note: figures in brackets are percent of Boston total.
See section at end of profile describing sources, as well as the methodology.
Source: a)

II. Demographics

Fenway-Kenmore is an area mainly of young adults. Over one-third of its residents lived in group quarters in 1985. Seen another way, one-third of Boston's total group quarters population lived in Fenway/Kenmore. The area had the highest proportion of student-age population, 15 to 24 years old, higher than any other neighborhood in Boston. There were also a good share of young adults, 25 to 34, but a notable lack of children, middle-aged adults and the elderly. Thus, Fenway-Kenmore had, at 24.7, the lowest median age of all city neighborhoods.

Table IIa. Population, 1985*

	Total	Population in group quarters	Household population	Persons per household
Fenway-Kenmore	42,320	16,436	25,884	2.1
City of Boston	601,095	49,595	551,500	2.4

* Note difference between total population and household population. Most of the following tables refer to household population as explained in the end notes for source b). Since the BRA household survey did not include group quarters population, the survey covers only the population residing in households. The survey did cover students living in private, non-institutional quarters.

Table IIb. Age Composition of Household Population, 1985
(in percent)

	Median age	0-14	15-24	25-34	35-54	55+
Fenway/Kenmore	24.7 yrs	11	43	30	10	7
City of Boston	28.8 yrs	17	23	22	20	18

Note: Percent may not total to 100 due to rounding. Persons living in group quarters were not included.
Source: b)

The share of minority population in Fenway-Kenmore has been growing in the 1980s, and the neighborhood has become home for a substantial Asian population in recent years.

Table IIc. Racial/Ethnic Composition of Household Population, 1985
(in percent)

	White, not Hispanic	Black	Hispanic*	Asian	Other races
Fenway/Kenmore	52	15	8	25	0
City of Boston	62	25	7	5	1

Note: Percent may not total to 100 due to rounding. Persons living in group quarters were not included.
Source: b)
* Hispanic includes self-designated Hispanics plus those who speak Spanish in the home or were born in a Spanish-speaking country

The student and young-adult character of Fenway-Kenmore was evidenced by its household composition in 1985. Single person households and unrelated individuals, living as roommates, comprised three-quarters of total households, whereas married couples and single-parent families totalled only one-quarter.

Table IId. Household Composition, 1985
(in percent)

	Traditional families and couples	Single parent households	Single person household	Household of unrelated individuals
Fenway/Kenmore	21	5	52	22
City of Boston	36	16	34	14

Note: Percent may not total to 100 due to rounding. Persons living in group quarters were not included.
Source: b)

III. Income and Poverty

The median income of Fenway-Kenmore at $16,300 was substantially below the citywide median in 1984. The overall neighborhood poverty rate was very close to the citywide rate, and a major improvement over 1979, but the rate for families remained higher and that for unrelated persons became lower than the citywide average.

Table IIIa. Median Household Income and Portion in Poverty, 1979 and 1984

	Median household income		Percent in poverty			
	1979	1984	1979 all persons	1984 all persons	1984 all families	1984 unrelated persons
Fenway/Kenmore	$ 8,362	$16,300	35	22	27	12
City of Boston	12,530	19,250	20	21	22	17

Note: Persons living in group quarters were not included.
Source: b)

IV. Mobility and Migration

Fenway-Kenmore had a very low proportion of residents born in Massachusetts, 23 percent. The large share of residents born in other states, Canada and elsewhere was indicative of its large student and young adult population. Their mobility is also evidenced by the finding that over two-thirds have lived in their dwelling less than two years, and only 8 percent of the neighborhood's households have lived in their dwelling six years or more, compared to 45 percent citywide.

Table IVa. Place of Birth of 1985 Residents
(in percent)

	Massachusetts	Other U.S. and Canada	Europe	Elsewhere
Fenway/Kenmore	23	46	3	29
City of Boston	55	25	5	15

Note: Percent may not total to 100 due to rounding. Persons living in group quarters were not included.
Source: b)

Table IVb. Years in Dwelling Unit of 1985 Household Residents
(in percent)

	<2	2-5	6-10	11-15	16+
Fenway/Kenmore	69	23	3	0	5
City of Boston	28	27	16	10	19

Note: Percent may not total to 100 due to rounding. Persons living in group quarters were not included.
Source: b)

V. Employment

Labor force participation was about the same for the neighborhood as for Boston as a whole, but the unemployment rate was much lower. Industries of the employed residents revealed a relatively large number of trade and services jobs. With 48,000 jobs, Fenway-Kenmore was the third largest job site of any Boston neighborhood.

The character of the Fenway-Kenmore area is shaped largely by its numerous medical and educational institutions. As job sources, these institutions attract professional, technical and service workers, many of whom are residents or become residents of the area. Eating and drinking establishments, business services, banks, and printing and publishing enterprises are the other major sources of jobs in the Fenway-Kenmore area.

Table Va. Labor Force Status, Spring 1985
(in percent)

	Participation rate (Persons aged 16 yrs +)	Unemployment rate
Fenway/Kenmore	64	*
City of Boston	66	6.2

Note: Persons living in group quarters were not included.
Source: b)
* Indicates less than 0.5 percent.

Table Vb. Industry of Resident Workers, 1985
(in percent)

	Manuf'g	Trade	F.I.R.E*	Services	Gov't	Other
Fenway/Kenmore	14	21	4	42	6	13
City of Boston	14	16	8	36	11	15

Note: Percent may not total to 100 due to rounding. Persons living in group quarters were not included.
* F.I.R.E. is an abbreviation for Finance, Insurance and Real Estate.
Source: b)

Table Vc. Employment Located Within Neighborhood, 1983

	Manuf'g	Trade	F.I.R.E.	Services	Gov't	Other
Fenway/Kenmore	2,400	8,900	2,500	30,800	1,400	1,900
City of Boston	48,900	81,000	78,800	171,000	91,500	58,100

Source: d)

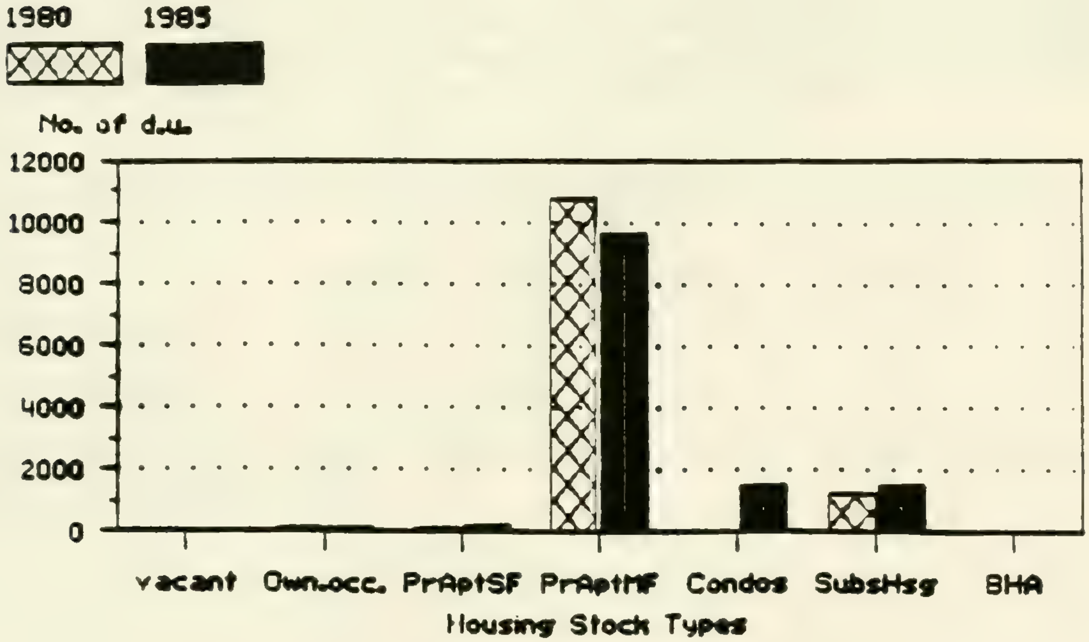
VI. Housing

Fenway-Kenmore had almost 13,000 housing units in 1985, about a 600 unit increase over five years. However, more than a third of its residents live in college dormitories or other group quarters. The rest live mainly in rental apartments, although conversions to condo tenure are now accelerating; by the end of 1985, one of every five housing units in the neighborhood was a condominium.

While residential turnover in this district is the highest in Boston, Fenway/Kenmore also had the lowest vacancy rate in the city, indicating that units fill up quickly. There were too few 1-3 family structures to determine averages for the area, but for multi-unit property owners, mean values in the neighborhood are among the highest in Boston. Median monthly gross rents, at $420, were slightly above the citywide level.

Fenway/Kenmore is the only planning district in the city with no public housing. Its housing stock is entirely owned privately. However, 11 percent of it is rental-assisted through federal or state programs.

Table VIa. Housing Stock Composition by Structure Types, 1980 and 1985
(in dwelling units)



FENWAY/KENMORE	Private Housing and Condos						Assisted Housing		
Stock types	1-4 vacant	Own.occ.	PrAptSF	PrAptMF	CondoSF	CondoMF	SubsHsg	BHA	Total
1-4(SF)/5+(MF)	1-4(SF)	1-4(SF)	1-4(SF)	5+(MF)	1-4(SF)	5+(MF)	Mixed	5+(MF)	Mixed
1980	8% 37	89	102	10,776	0	49	1,230	0	12,283
% of pl.dist.	0	1	1	88	0	0	10	0	100
1985	1% 5	105	144	9,686	88	1,389	1,480	0	12,397
% of pl.dist.	0	1	1	75	1	11	11	0	100
change '80-'85	(32)	16	42	(1,090)	88	1,340	250	0	514
% chg from '80	(86)	18	41	(10)	inf	2,735	20	0	5

Note: Group quarters were not included.
Source: c)

Table VIb. 1-3 Family Property Values and Median Gross Rents, 1980 and 1985

	1-3 family property values		Median monthly gross rents	
	1979	1986	1980	1985
Fenway/Kenmore	N/A	N/A	$252	$420
City of Boston	32,000	115,000	254	400

Note: N/A means not available because there were too few instances.
Source: b)

VII. Transportation

Most Fenway-Kenmore residents either walk to work or use public transportation. Only 19 percent use autos to get to work. A remarkable 60 percent of all households have no private vehicles, while 40 percent have either one or two. This compares to 39 percent without autos and 61 percent with vehicles, citywide.

Table VIIa. Means of Household Transportation to Work, 1985
(in percent)

	Vehicle	MBTA	Walk	Other
Fenway/Kenmore	19	36	43	2
City of Boston	50	33	15	3

Note: Percent may not total to 100 due to rounding. Persons living in group quarters were not included.
Source: b)

Table VIIb. Number of Vehicles Owned per Household, 1985
(in percent)

	None	1	2	3 or more
Fenway/Kenmore	60	33	7	0
City of Boston	39	42	14	5

Note: Percent may not total to 100 due to rounding. Persons living in group quarters were not included.
Source: b)

VII. Summary of Recent and Imminent Development

The Fenway-Kenmore planning district will see an investment of $1.2 B (billion) in development over the 1975 to 1989 period, according to source e). Industrial development is the largest single element, accounting for $457 M (million) or 38 percent of all development in the district, dominated by the MATEP project. MATEP, which stands for Medical Area Total Energy Plant, consists of a $336 M power plant completed in 1981 producing electricity and steam for the hospitals in the Longwood Medical Area.

Medical investments in hospitals and research centers in the Longwood Medical Area will total $342.6 M (28%) during this period, resulting in 2.7 M square feet (SF) of space and 377 additional beds. The major years for medical development were 1978 and 1980 when nearly two-thirds of this medical space was completed.

The third largest component of Fenway-Kenmore development is residential construction which will sum to $179 M (15%). This development will have produced 2,678 dwelling units (DU), of which two-thirds are new units and one-third are renovated units. The types of residential units developed include 560 condominiums, 1,669 rental units, 62 co-op apartments, and 449 unclassified units.

The educational institutions will have invested $83.7 M (7%) into the Fenway-Kenmore neighborhood, resulting in 754,400 SF of educational space. The major developments in the Fenway Kenmore area include the $16 M Harvard Teaching Center and the former Boston State College building which cost $15 M.

Sources and Methodology

a) - *U.S. Census of Population and Housing, 1950 - 1980*

b) - *B.R.A. and P.F.D. Household Survey, 1985*, conducted by the Center for Survey Research, U. Mass. at Boston. A sample of over 2,000 households, carefully drawn to reflect Boston's household population, was questioned in the spring of 1980, to parallel the 1980 U.S. Census. In 1985, exactly five years later, the same methodology was employed again to obtain an update and to identify neighborhood shifts. This survey did not include the group quarters population

To learn more about changes in these planning districts by 1985, the several thousand observations available from the 1985 BRA/PFD Household Survey were differentiated to the limit. Knowing such changes as the shift in number of persons by race/ethnicity and age group in each district is valuable for planning. However, this divides the available data into so many cells that it limits reliability tests. The inferences should therefore be viewed as suggestive rather than conclusive.

c) - *Boston's Changing Housing Patterns, 1970 to 1985*, Rolf Goetze, consultant to the B.R.A., November 1986. The 1980 U.S. Census does not specifically identify assisted dwelling units or the structure types within which they occur. It also does not indicate the type of stock in which condominiums are located, or when rental dwellings are in resident-owned structures. Therefore, available city data were carefully analyzed to obtain an overview and identify current housing patterns, as described in this source paper.

To aid in tracing the 1980 to 1985 changes in Table VIa, the housing stock was divided into units located in 1-4 unit structures, and those in 5 or more multi-unit structures. The 1-4s, dubbed **1-4(SF)** for single family, are largely singles, duplexes and triple-deckers, and tend to have a high rate of owner occupancy. **PrAptSF** designates the private apartments rented in this stock. In 1984, significant condominium conversion of triple-deckers commenced in some districts, shown as **CondoSF**.

Multifamily is designated as **5+(MF)**, and includes private rentals in this stock, **PrAptMF**, and condominiums, **CondoMF**, as well as public housing owned and managed by the Boston Housing Authority, **BHA**. Subsidized housing, **SubsHsg**, refers the to privately-owned developments assisted under such federal programs as Section 221(d)(3), Section 236, and Section 8, as well as state assistance programs under EOCD and MHFA. The newly built assisted housing tends to be in multifamily structures, whereas the rehabilitated stock is more likely to be in 1-4 unit stock.

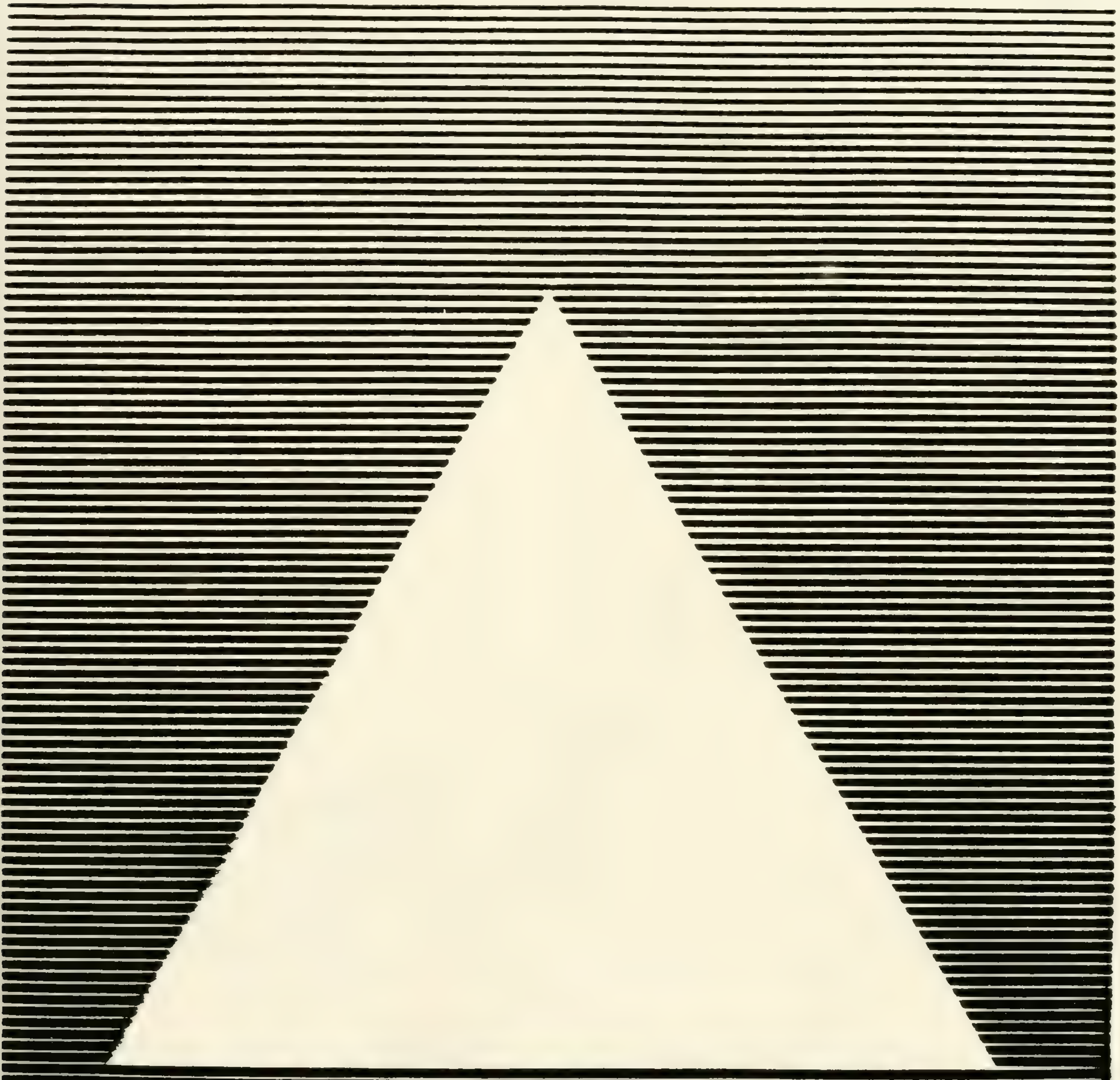
Table VIa also shows how the total stock in each time period is distributed, as well as the absolute and percent change.

d) - *U.S. Bureau of the Census, "County Business Patterns," 1983*

e) - *A Summary and Survey of Development in Boston, 1975 - 1989*, John Avault and Mark Johnson, April 1987, based on compilations maintained on "ULTRALIST" by the BRA Research Department

MISSION HILL FENWAY KENMORE

PLANNING ADVISORY COMMITTEE



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MISSION HILL/FENWAY/KENMORE

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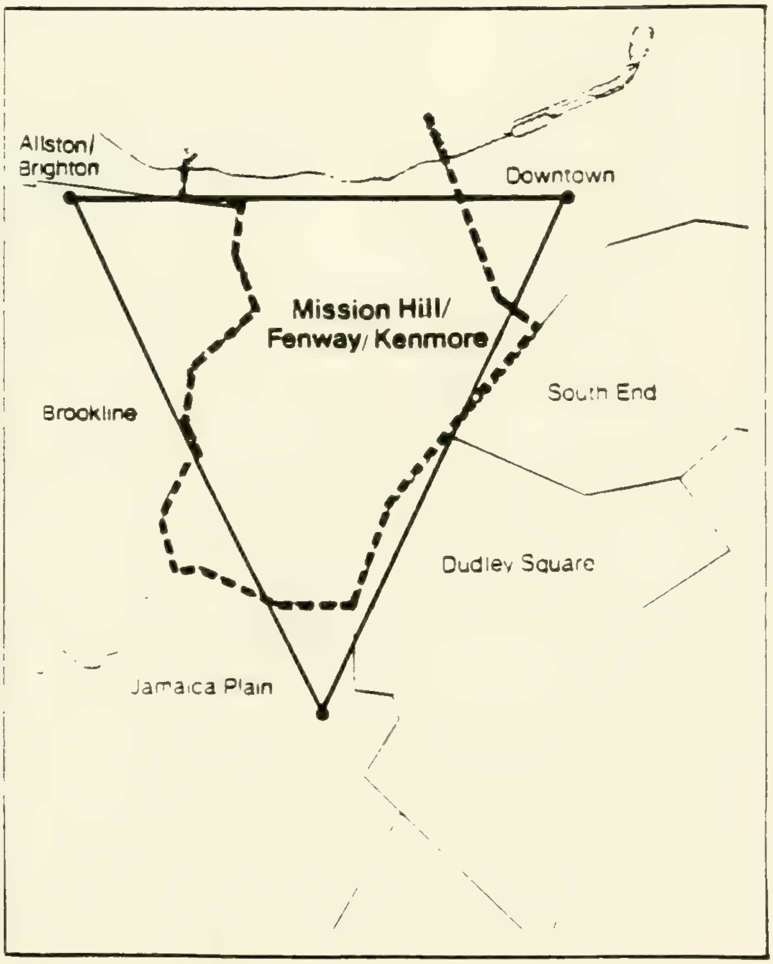
Executive Summary

The recent expansion of medical and educational institutions in an area forming a rough triangle, extending from Mission Hill to the Fenway to Kenmore Square, has brought to the forefront many planning and development issues which are of concern to area residents. These concerns include issues such as traffic and parking, the supply and affordability of area housing, commercial area revitalization, the management of institutional expansion and open space preservation. While residents and institutions have themselves established planning organizations in an attempt to resolve some of these planning issues, their efforts have, for the most part, been focused on specific neighborhood/institutional problems. It is now recognized that a coordinated, area-wide effort is needed to analyze regional concerns such as traffic and parking.

The formation of a 12 member Planning Advisory Committee to oversee an area-wide consultant traffic and parking study for the Mission Hill/Fenway/Kenmore district is seen as the initial step toward resolving some of the regional issues. The Advisory Committee will be appointed by the Mayor, and will represent the neighborhoods, institutions, and public agencies present in the Mission Hill/ Fenway/Kenmore district.

MISSION HILL/FENWAY/KENMORE
MAP 1 Study Area Boundary



The Advisory Committee will work closely with staff from the BRA and the Boston Transportation Department in the definition of a scope of services for the study and in the selection of a traffic consultant. Once underway, the study is anticipated to take between 12-18 months to complete. As part of its ongoing responsibilities, the Committee also will review those institutional development projects which significantly impact the regional transportation network for the area. Following the completion of this study effort, the Committee will consider what additional issues could most appropriately be addressed.

The following report is divided into four sections and contains an executive summary. Section I provides a general profile of the Mission Hill/Fenway/Kenmore study area as well as a description of each neighborhood sub-area. Table 1, found on page 13, details the characteristics of each neighborhood sub-area in terms of physical structure, institutions present, neighborhood associations, current projects, and issues/concerns of particular interest to the neighborhood. Section II identifies the more general area-wide issues of concern for the study area such as transportation, commercial area deterioration, housing, institutional expansion and open space. Each substantive area is reviewed both in terms of its historical background and its current/proposed development activities. Section III describes the proposed process of community participation and suggests proposed responsibilities for the committee. The final section of the report lists the next steps to be undertaken in the advisory committee process.

I. STUDY AREA

Profile

The Mission Hill/Fenway/Kenmore Triangle is located west of downtown Boston. The area is home to many of Boston's thriving residential communities, hospitals and universities, cultural and entertainment attractions, and important commercial districts. The Triangle area is bounded by Heath Street and the Southwest Corridor Tremont Street to the south, Massachusetts Avenue to the east, the Riverway to the west, and Kenmore Square to the north.

In 1980, there were 41,905 people residing in the Mission Hill/Fenway/Kenmore study area, accounting for 7.4% of the City of Boston's entire population. A large percentage of this population were students attending area universities.

The student influence is also reflected in the housing market for the study area. Multi-unit, rental housing is by far the most common housing type, with 84% of the housing units in structures of five or more units. Only 4% of the area's total housing stock was owner-occupied in 1980.

The largest employers in the study area were the hospitals and universities, providing 32,000 jobs in 1983. When combined with the transportation of labor force statistic indicating that 72% of the area's workers either walked or took public transportation to get to work, the importance of the feeder role played by adjacent residential neighborhoods to area institutions cannot be understated.

Medical institutions dominated development in the study area from 1976-1984, responsible for nearly 70% of the over $853 million spent on new construction and rehabilitation during that period. Residential construction and rehabilitation was next in magnitude, amounting to over $170 million (20% of total) for 3,156 dwelling units.

Other relevant indicators for the study area area as follows:

Population (1980 data)

- The area had a relatively young population -- 32% in the 20-24 age bracket and 22% in the 15-19 age bracket. (City-wide, persons in these two age brackets, combined, comprised only 24% of the total population.)
- Families comprised only 26% of the area's households in comparison to 54% in the city.
- Large number of persons lived in group quarters (32% of all persons in the area).

These population statistics evidence the presence of a large student population in the area.

Income (1979 data)

- The area had a relatively low household and per capita income. Only 27% of all households in the area earned over $15,000, while 42% of

households in the City had incomes over that amount. Per capita income was $5,210 in the area, compared to $6,555 in the City. Furthermore, 29% of the area's families and 35% of all persons were below the poverty level.

- Many of the area's households were single students who worked part-time, if at all, and had low earnings.

Education (1980 data)

- Residents were well-educated. 78% of the persons 25 years and older were high school graduates, compared to 68% in the City as a whole; and one-third had completed four or more years of college, in contrast to one-fifth in the City.

Labor Force (1980 data)

- The unemployment rate in the area was relatively low -- 5.4% compared to 6.1% in Boston.
- 45% of the area's working residents were employed in professional and related services, including health care and education.

Transportation of Labor Force (1980 data)

- Means of transportation to work were primarily walking (39%) and public transportation (33%).
- Only 25% travelled to work by car, truck or van, compared to 42% for residents of the City as a whole.
- Walking to work was most prevalent in the Kenmore (28%) and Longwood Medical Center (45%) neighborhood areas.

These data are evidence that workers in the medical and educational institutions tend to reside in the vicinity of their workplaces.

Housing (1980 data)

- Multi-unit, rental housing dominates the area.
- Only 4% of the area's units are owner-occupied, compared to 27% in the City as a whole.
- 84% of the area's housing units are in structures of five or more units, compared to 43% in all of Boston.
- Tenants in the renter-occupied housing units were quite mobile: 46% of the householders moved into their units from 1979 to March 1980 in comparison to 32% city-wide.
- The area had a large stock of condominiums as of June 30, 1983. Sixty conversion cases produced 1,237 units, most of which were in the Fenway-Kenmore area. Most of the condominium development occurred after 1980.

Workplaces and Employment

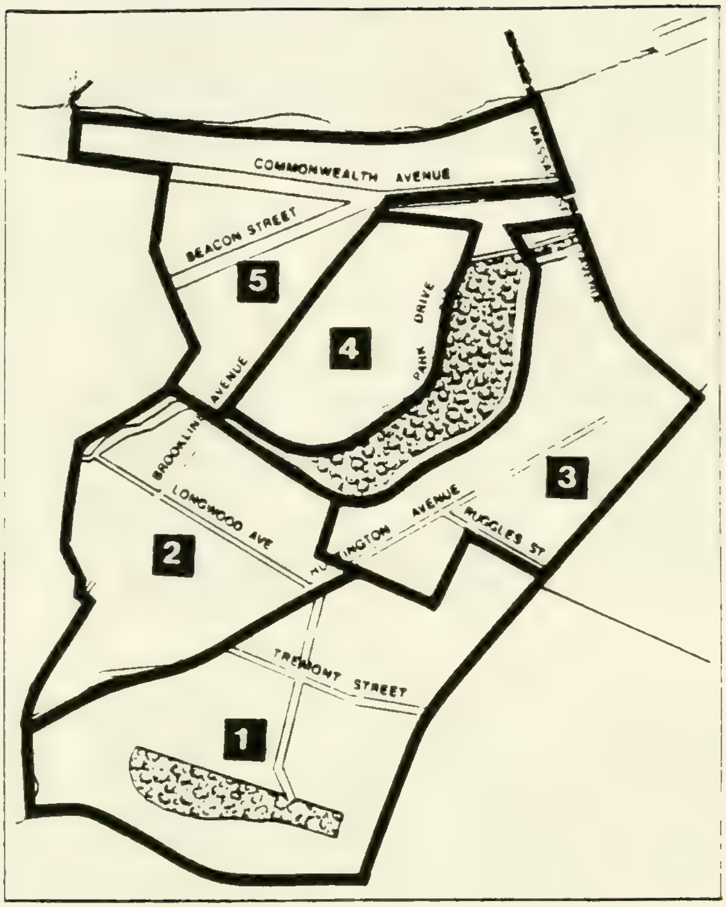
- As of 1981, over 1,000 private business establishments were located in the area. Those establishments employed over 48,000 workers, or 11% of Boston's private employees.
- The largest employers were mainly hospitals and universities; those with 500 or more employees accounted for 32,000 jobs in 1983.
- By type of business, services dominated the local economy, with 72% of the area's private employment. Retail trade (17% of total) was the only other substantial sector.

Large Developments

- From 1976 to 1984, over $853 million were spent on new construction and rehabilitation of structures.
- Medical institutions dominated development from 1976-1984, accounting for 68% of construction spending. The new and rehabilitated structures amounted to over 2.3 million square feet of space.
- Second in magnitude, residential construction and rehabilitation amounted to over $170 million (20% of total) for 3,156 dwelling units.
- Except for cultural and recreational construction ($36 million or 4% of total) development in other categories was of relatively small magnitude.

(The information on population, income, housing, and employment presented above is taken from the U.S. Bureau of the Census Neighborhood Statistics Program for 1980. Tables 1-12 in the data base report, available under a separate cover, provide greater detail of the area's socio-economic characteristics).

MAP 2 Sub Areas



1 Mission Hill
2 Longwood Medical Area
3 East Fens
4 West Fens
5 Kenmore Square/Audubon Circle

SUB-AREAS

Five neighborhood sub-areas have been identified in the Mission Hill/Fenway/Kenmore study area. Shown on Map 2 above, the five sub-areas include (1) Mission Hill; (2) Longwood Medical Area; (3) East Fens; (4) West Fens; and (5) Kenmore Square/Audubon Circle. A brief description of each follows.

1. Mission Hill

The Mission Hill sub-area is located along the southern edge of the study area and is primarily residential in nature, with two and three-family homes dominating the housing stock. The sub-area is bounded by Ruggles Street to the north, Heath Street to the south, the Southwest Corridor to the east, and Huntington Avenue to the west. The institu-

tion exerting the greatest influence in the area is the New England Baptist Hospital. Other institutions in the immediate area include the Harvard Community Health Plan and the Veterans Administration Hospital. Neighborhood interests and concerns for Mission Hill include (1) traffic and parking; (2) upgrading existing housing including the Mission Hill Main and Extension Projects; (3) stabilizing housing opportunities for low and moderate-income residents; and (4) revitalizing the Brigham Circle commercial area.

2. Longwood Medical Area

The Longwood Medical Area is the major center for the City of Boston's medical services. Hospitals in the area include Brigham and Women's, Beth Israel, Children's and the New England Deaconess. In addition to the medical facilities in the area, there are numerous educational institutions (Harvard Medical School, Massachusetts College of Art, Roxbury Community College). The sub-area is bounded by the Fenway to the north, the Jamaica Way to the south, Huntington Avenue to the east, and the Riverway to the west. Of prime concern to the residents and institutions in the Longwood Medical Area are issues of (1) traffic and parking; and (2) the management of institutional expansion.

3. East Fens

The East Fens sub-area is primarily a residential area with apartments as the dominant use. The sub-area is bounded by Massachusetts Avenue to the north, Ruggles Street to the south, the Southwest Corridor to the east, and the Fenway to the west. The institution that has the most impact on this sub-area is Northeastern University. Other institutions in the area are the Museum of Fine Arts and Symphony Hall. Neighborhood interests and concerns include (1) stabilizing housing opportunities for low and moderate-income tenants; and (2) controlling traffic congestion in the area through the vigorous enforcement of the resident sticker program; and (3) upgrading the Huntington Avenue/Massachusetts Avenue commercial district.

4. West Fens

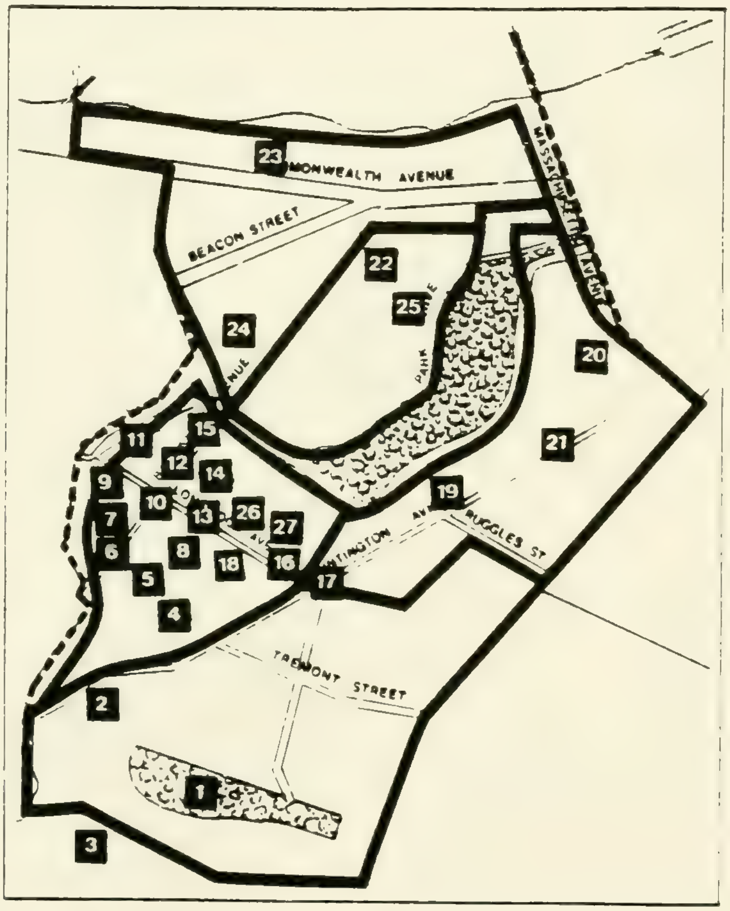
The West Fens sub-area is also primarily a residential area with apartments as the dominant type of housing. The sub-area is bounded by the Massachusetts Turnpike to the north, Park Drive to the south and east, and Brookline Avenue to the west. The institution most influencing this sub-area is Fenway Park and the Red Sox. Other institutions present in the area include Boston University and the Harvard Community Health Plan. Of prime concern and interest to this sub-area are (1) stabilizing housing opportunities for low and moderate-income tenants; (2) controlling traffic congestion through the rigorous enforcement of the resident sticker program; (3) controlling the infusion of surface parking lots; and (4) promoting the mix-use development of under-utilized parking lots.

MAP 3

MISSION HILL/FENWAY/KENMORE - Institutional Uses

1. New England Baptist Hospital
2. Harvard Community Health Plan Hospital
3. Veterans Administration Hospital, Jamaica Plain
4. Brigham & Women's Hospital
5. Dana Farber Cancer Institute
6. Joslin Diabetes Center
7. New England Deaconess Hospital
8. Children's Hospital
9. Temple Israel
10. Winsor School
11. Wheelock College
12. Simmons College
13. Mass. College of Art
14. Beth Israel Hospital
15. Emmanuel College
16. Massachusetts College of Pharmacy and Allied Health Sciences
17. Mass. College of Art/Roxbury Community College
18. Harvard Medical Schools
19. Museum of Fine Arts
20. Symphony Hall
21. Northeastern University
22. Boston Red Sox
23. Boston University
24. Harvard Community Health Plan
25. Boston Latin Academy
26. English High School
27. Boston Latin School

MAP 3 Institutional Uses



5. Kenmore Square/Audubon Circle

The Kenmore Square/Audubon Circle sub-area is a major commercial center as well as the focus for much of the campus of Boston University. As part of an ongoing process, Boston University has set up a University-Community Task Force to deal with University-Community relations. The sub-area is bounded by Massachusetts Avenue to the north, the Boston University Bridge to the south, Brookline Avenue to the east, and Storrow Drive to the west. Neighborhood interest and concerns include (1) the provision of adequate parking without the further congestion of the local streets; (2) the regulation of licensed commercial uses; and (3) the stabilization of housing opportunities for low and moderate-income tenants.

Table 1, on the following page, outlines the characteristics of each sub-area in terms of physical structure, institutions present, neighborhood associations, current projects, and interests/concerns of the neighborhood.

Table 1

Characteristics of the Sub-Areas

Sub-Areas Characteristics	Mission Hill	Longwood Medical Area	East Fens	West Fens	Kenmore Square Audubon Circle
Physical Structure	o Primarily residential o Mostly 2-3 family homes and small apartment houses.	o Primarily educational and medical institutions in buildings of varying heights located in campus settings.	o Primarily residential area containing mostly apartments (average 4 stories).	o Primarily residential area containing mostly apartments (average 4 stories).	o Commercial District. o Numerous licensed, commercial activities. o Townhouse residential area adjacent to Charles River. o Audubon Circle apartments (average 4 stories) area
Institutions (See Map 3 for Locations)	o New England Baptist Hospital o Harvard Community Health Plan Hospitals o Veterans Administration Hospital	o Harvard Medical School o Mass College of Pharmacy & Allied Health Science o Wheelock College o Simmons College o Emmanuel College o Children's o Brigham and Women's o Dana Farber Cancer Institute o Joslin Diabetes Center o New England Deaconess o Beth Israel o Winsor School o Temple Israel o English High School o Boston Latin School	o Northeastern University o Christian Science Mother Church o Symphony Hall o Massachusetts College of Art o Roxbury Community College	o Fenway Park o Boston University o Boston Latin Academy o Harvard Community Health Plan	o Boston University expansion.

Table 1

Characteristics of the Sub-Areas (continued)

Sub-Areas Characteristics	Mission Hill	Longwood Medical Area	East Fens	West Fens	Kenmore Square Audubon Circle
Neighborhood and Institutional Organizations	o Mission Hill Planning Commission o Mission Hill and Extension Development Task Forces o Triangle Association o Back of the Hill Association o Neighborhood Housing Services o Roxbury Tenants of Harvard Residents o Brigham Circle Merchants	o Medical Area Service Corporation (MASCO) o Roxbury Tenants of Harvard Residents	o Fenway Civic Assoc. o Fenway Community Development Corp. o Symphony United Neighborhoods o Massachusetts Ave. Merchants o Boston Fenway Program	o Fenway Civic Assoc. o Boston Fenway Program	o Bay State Road Civic Association o Bay State Road Neighborhood Assoc. o Kenmore Association o Boston Fenway Program o Audobon Circle Neighborhood Assoc.
Projects	o Mission Hill Main and Extension improvements o 706 Huntington Ave o Brigham Circle commercial area improvements	o Longwood North doctor's office/garage project o Children's Hospital replacement bed addition. o Brigham and Women's ambulatory building and garage. o Children's Inn expansion.	o Recent substantial improvements including street and alley upgrading, renovation and development of housing, and commercial projects as part of the Fenway Urban Renewal Plan.		o Boston University Bookstore new stores, sings, trees, planting

Table 1
Characteristics of the Sub-Areas (continued)

Sub-Areas Characteristics	Mission Hill	Longwood Medical Area	East Fens	West Fens	Kenmore Square Audubon Circle
Interests/Concerns	o Up-grade housing o Stabilize housing opportunities for low/moderate income residents. o Revitalize Brigham Circle commercial area. o Undertake open space preservation projects.	o Adopt policies and construct improvements to facilitate traffic flow and provide adequate parking. o Coordinate institutional expansion projects with area planning goals.	o Stabilize housing opportunities for low/moderate income tenants. o Control traffic congestion and enforce resident sticker program to control commercial parking in residential area. o Up-grade the Fens Park.	o Stabilize housing opportunities for low/moderate income tenants. o Control traffic congestion and enforce resident sticker program to control commercial parking in residential area o Control intrusion of surface lots. o Promote mixed-use development of under-utilized parking lots. o Up-grade the Back Bay Fens	o Provide adequate parking to serve area without further congesting local streets o Regulate expansion of licensed commercial uses o Stabilize housing opportunities for low/moderate income tenants o Coordinate institutional expansion projects with area planning goals.

II. ISSUES OF CONCERN

The primary issues of concern to residents and institutions in the Mission Hill/Fenway/Kenmore triangle focus on transportation matters. They include management of institutional expansion to minimize potential traffic and parking impacts and the need to implement various proposed traffic and public transit improvements. Additional concerns in the area relate to the need for upgrading commercial areas, the provision of adequate housing for students and residents of low and moderate income, the preservation of open space and the review of institutional development projects. Table 1 identified the specific concerns of each sub-area. A more generalized discussion of the issues follows.

A. Transportation

Background

The study area is affected by the traffic and parking problems of a growing city. These problems include increased traffic flow and inadequate parking as well as the localized impacts of specific institutions.

The major regional traffic corridors which service this area -- Massachusetts Avenue, Columbus Avenue, Commonwealth Avenue and the Riverway -- and the major radial streets including Huntington Avenue, Brookline Avenue, Ruggles Street and Park Drive are now functioning at or near capacity. There is a need to understand the traffic flow on these streets, to make projections for additional future growth, and to identify improvements which might be undertaken to minimize the adverse traffic impacts.

In addition to the broad, city-wide traffic and parking concerns, there are a number of local concerns related to: the impacts upon a given area resulting from specific development activities, traffic impacts of existing major facilities, and underutilized surface parking lots.

The New England Baptist Hospital and Brigham and Women's Hospital expansion plans, for example, have been a major source of community concern. The adjacent neighborhoods would like to see both short and long-term measures undertaken to deal with the potential traffic and parking impacts of these developments. Additional institutions such as the Dana Farber Cancer Institute and the New England Deaconess are planning various development activities which will reinforce the need to develop common strategies to deal with potential traffic and parking problems

In some cases, institutions are planning to construct parking facilities to address a shortfall in parking demand. MASCO, Northeastern University, New England Baptist Hospital, the Red Sox, have all discussed at one time or another the possibility of building parking facilities. These projects could be beneficial if undertaken in concert with other measures to minimize the traffic and parking impacts and up-grade the area.

The numerous surface parking lots located throughout the Mission Hill and West Fenway area serve the needs of employees working in the adjacent institutions. However, some of these lots may not exhibit the best use of land and should be considered for mixed-use development of housing, office, and parking within the context of a plan to address the area's parking needs.

Review of Transportation Improvements (Current and Proposed)

The major radial streets serving the area must be improved if traffic on the inner residential streets is to be minimized. A number of traffic and public transit improvements have been proposed over the years to address the regional access issue in the district. (See Map 4 for locations of proposed traffic/transit improvement projects.) The Sears rotary and Huntington Avenue Phase III are currently being discussed with appropriate State agencies.

Transportation Development Opportunities/Activities

1. Huntington Avenue III:

   As currently planned, the Huntington Avenue Phase III project will, by narrowing the sidewalk, provide an additional lane to facilitate traffic flow and improve service on the Arborway line.

2. Sears Rotary:

   The Sears rotary improvement will force southbound traffic at Sears to utilize the rotary rather than Brookline Avenue. Since most of this traffic is regional in nature, it is expected that this traffic will continue south along the Riverway rather than return to Brookline Avenue to travel south.

3. Brookline Ave./Riverway:

   A proposal to make Brookline Avenue northbound and the Riverway southbound is considered as a viable strategy to ease traffic congestion in the Longwood Medical area. This plan needs further analysis and consideration by various public agencies.

4. Longwood Ave. widening:

   As development takes place on Longwood Avenue, from Brookline Avenue to Blackfan Street, buildings will need to be set back so that the street can be widened by an additional traffic lane.

5. Ruggles Street:

   It serves as a major traffic corridor for vehicles traveling around the perimeter of the City from Boston City Hospital and the Expressway to the Longwood Medical area. The Inner Belt was a proposal for accommodating this flow which, because of its impact, was terminated as a project. Additional studies are needed to come up with a new plan to accommodate this circumferential traffic.

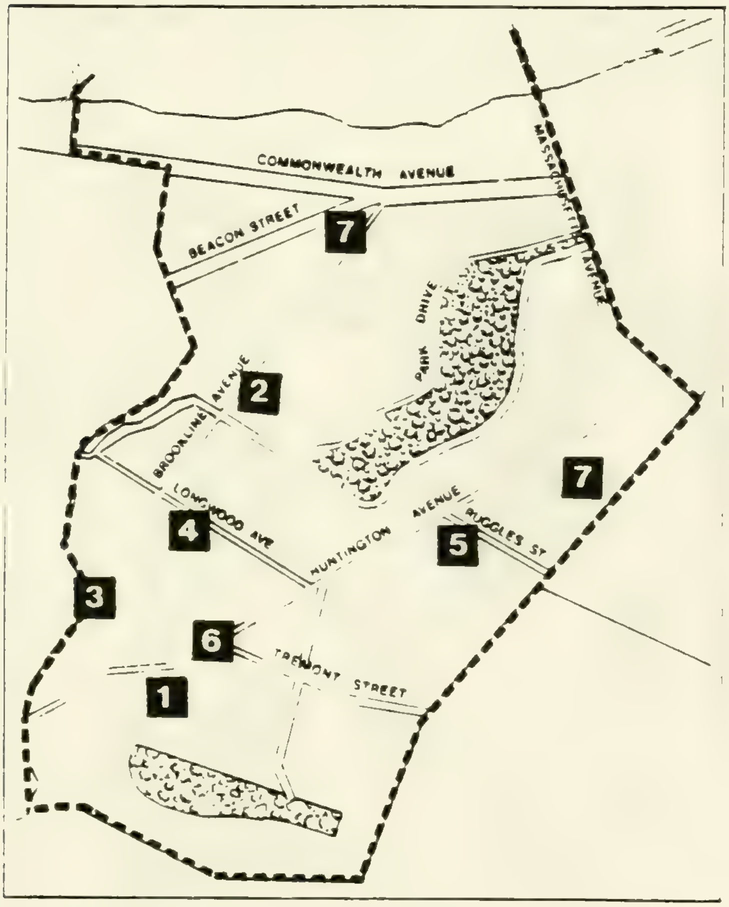
6. Francis Street Improvements:

It is proposed that parking on the north side of Francis Street be removed in front of the new Brigham and Women's garage and Ambulatory Services Building and that the street be re-stripped so that there is adequate width for traffic flow in each direction. Another proposal which will require substantial analysis, would restrict the through flow of traffic on Francis Street.

7. Parking Facilities:

Northeastern University has plans for a five-story, 1,000 space parking garage. The Red Sox also are considering building a parking garage on the site of their current lot.

MAP 4 Proprosed Traffic/Transit Improvements



1 Huntington Ave Phase III
2 Sears Rotary
3 Brookline Ave /Riverway
4 Longwood Ave
5 Ruggles Street
6 Francis Street
7 Proposed Parking Facilities

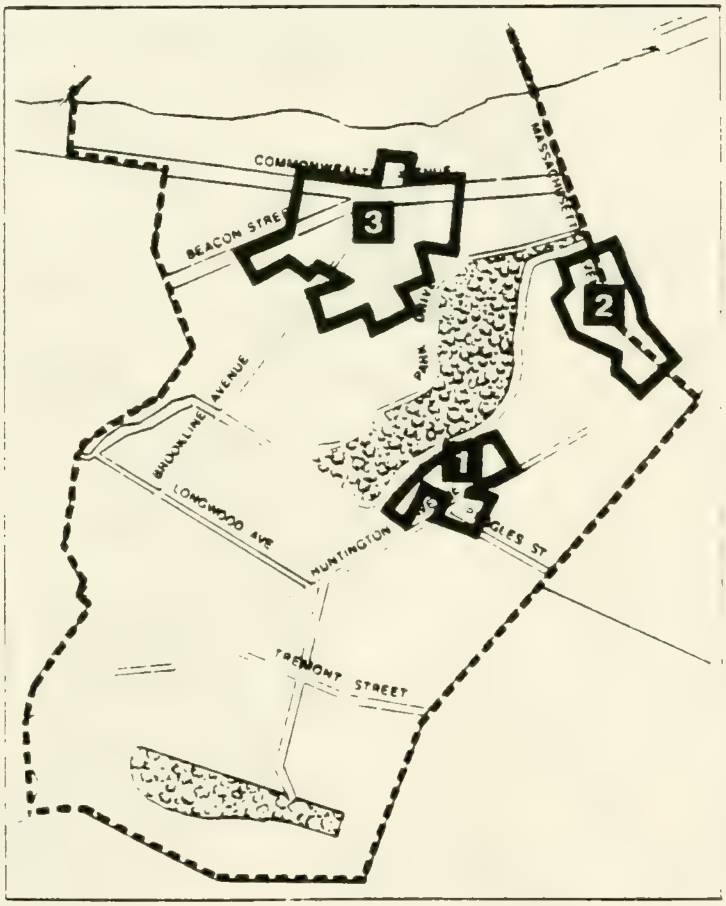
B. Commercial Area Deterioration

Background

Upgrading neighborhood commercial areas has long been a focus in this district. Although commercial area deterioration continues to be a major problem, some progress including the following has been made in recent years.

1. Three Commercial Area Revitalization Districts (CARD) -- Museum of Fine Arts/Huntington Place, Kenmore Square, and Massachusetts Ave. and East Fenway have been established in the area. (See Map 5).
2. Improvements to commercial establishments located along Massachusetts Avenue and in Kenmore Square have been carried out.
3. Improvements to commercial establishments at Brigham Circle have been undertaken.

MAP 5 Commercial Area Revitalization Districts



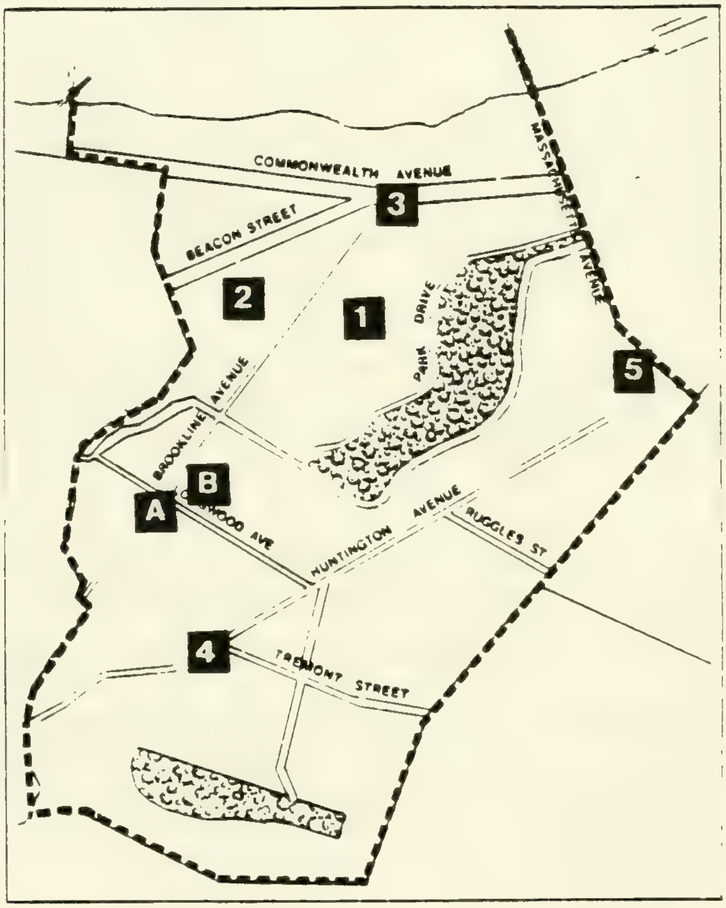
1 Huntington Place, Museum of Fine Arts
2 Kenmore Square
3 Mass. Ave./East Fenway

Review of Commercial Improvements (Current and Proposed)

Many groups, public and private, are working toward upgrading the commercial areas in the Mission Hill/Fenway/Kenmore Triangle. Such work might be enhanced by fostering a sense of cooperation and communication among the various organizations working toward commercial revitalization of the area. The vehicle for such cooperation is yet to be determined but may well be contained in the Advisory Committee process in the form of a commercial area sub-committee.

Future activities planned for the upgrading of commercial areas include various projects as listed below which are either under construction or are being considered.

MAP 6 Commercial Development Opportunities/Activities



A	Children's Inn
B	Longwood North
1	Boylston Street
2	Red Sox Parking
3	Kenmore Square
4	Brigham Circle
5	Huntington Ave /Mass Ave

Under Construction

A. Children's Inn Renovation:

Addition of 32,000 sq.ft. of retail, 30,000 sq.ft. of office space and 82 hotel rooms.

B. 333 Longwood

Recent completed construction of a 500 car garage (net addition of ±250 spaces) and 75,000 sq.ft. of ground floor retail/office space.

Commercial Development Opportunities/Activities

1. Brigham Circle:

Possible designation of Brigham Circle as a CARD district.

2. Boylston Street:

A number of surface parking lots exist on Boylston Street which are used primarily for Red Sox parking. These under-utilized properties could be developed for a mix of housing/parking and commercial uses as long as there is at the same time a strategy to deal with the area's deficit of commuter parking spaces.

3. Red Sox Parking:

The Red Sox parking lot located on Brookline Avenue and Beacon Street has been considered as a viable site for a parking garage and air rights commercial/housing development.

4. Kenmore Square:

Development of Deerfield/Commonwealth Avenue site for the B.U. School of Hotel Management and Conference Center.

5. Massachusetts Avenue/Huntington Avenue:

Initiation of improvement efforts within the Massachusetts and Huntington Avenue commercial district.

C. Housing

Background

A major concern to both residents and institutions is both the increasing cost and the growing unavailability of housing in the area for long-term residents and employees. This concern is also related to the area's traffic issues. Currently 38% of employed residents in the district walk to work in contrast to 17% for the City of Boston. Housing strategies will have to be developed in order to continue to minimize a reliance on auto access for the journey to work.

Three specific housing issues are of concern to various sub-areas of the district: decrease in the existing supply as a result of Boston University's expansion, disposition and development of the vacant Lahey property for housing purposes, and the initiation of development opportunities which are responsive to residents' concerns.

The expansion of Boston University into adjacent residential areas is an issue that has received increased attention in recent years. The prime concern of the residents in neighborhoods surrounding Boston University is the preservation of affordable housing. As noted previously, the University has initiated dialogue on this and other community concerns through its University-Community Task Force.

Another institution which has affected the area's housing market is the Lahey Clinic. During the late 1960's and early 1970's the clinic purchased a substantial portion of the Back of Mission Hill -- an area bounded by Heath Street and Fisher Avenue -- in order to provide a site for the development of a new clinic. After purchasing the property and demolishing many residences, a decision was made to locate the Lahey Clinic in Burlington. This property remains a prime development parcel. Thus far, Lahey and the Back of the Hill Neighborhood Association and the City have been unable to agree on a disposition plan for the redevelopment of this parcel.

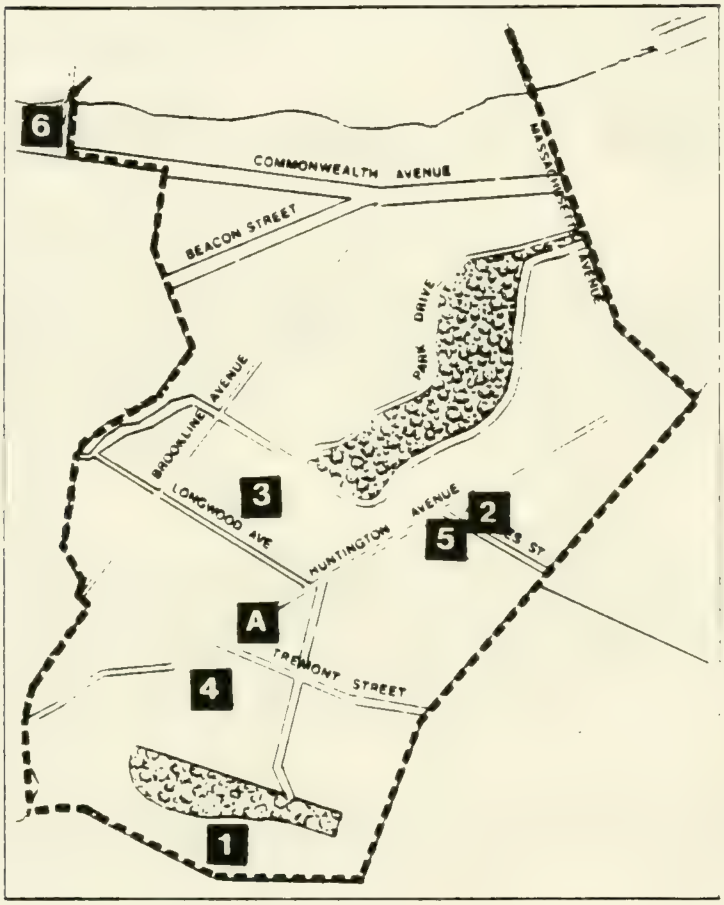
The quarry site owned by Harvard University is a good example of a development opportunity that would benefit from increased dialogue. Thus far, at least two possibilities have been mentioned for the site. (1) housing and (2) open space preservation.

Both the institutions and neighborhood groups have mutual interest in the development of affordable housing. This housing is needed to provide accommodations on campus or in the Triangle district for the increasing number of students and families who need to reside in the area.

Review of Housing Improvements (Current and Proposed)

A number of housing development sites all of which are controlled by various institutions exist within the Triangle District. These locations are identified below. These sites might be used to provide on-campus student housing and/or off-campus residence for employees in the area.

MAP 7 Housing Development Opportunities



A 706 Huntington Ave
1 Lahey Clinic Site
2 Wentworth Institute
3 Emmanuel College
4 Quarry Site
5 Tavern Road
6 Armory Site

Under Construction

A. 706 Huntington Avenue:

Forty units of rehabilitated housing are currently under construction at 706 Huntington Avenue. The site is owned by Brigham and Women's Hospital and is being developed in cooperation with Mission Hill Neighborhood Housing Services.

Housing Development Opportunities/Activities

1. Lahey Clinic:

Vacant site on back of Mission Hill. The City is presently working with Lahey Clinic on a disposition plan for the property.

2. Wentworth Institute:

Site owned by Wentworth. This site could be leased to an institution in the area for mixed-use housing, parking and retail development.

3. Emmanuel College:

Located adjacent to English High off Avenue Louis Pasteur is a parcel of land consisting of Alumnae Hall and a surface parking lot. A mixed-use development possibly including housing could be considered for this site.

4. Quarry Site:

Harvard University owns, adjacent to Brigham Circle, a parcel of land consisting of an at grade surface parking lot/ shopping center behind which is located a large ledge area. Opportunities exist to preserve a portion of the site as open space as well as develop housing, parking and commercial uses.

5. Tavern Road:

Northeastern University is considering the development of dormitory housing on parcel of land which it controls on Tavern Road.

6. Armory Site:

Assuming the property can be conveyed to Boston University allowing for residential re-use, the University is committed to develop student housing.

D. Institutional Expansion

Background

Because medical and education institutions are conditional uses in Boston, special permits must be sought before the Zoning Board of Appeals (ZBOA) in order to obtain a building permit. As a consequence of this review process, institutions must undergo a lengthy community review of their project before they receive ZBOA and BRA approval.

Major concerns of the residential groups include the expansion of institutions beyond their current boundaries into existing residential areas, the mix of uses and the magnitude of proposed development. Where major changes are proposed, the BRA planning review includes an analysis of the institution's master plan. The Authority wants to be certain that the development is based upon a logical planning process and that the institution and the adjacent area can adequately accommodate the projected growth. A thorough impact analysis is needed for proposals which include additional parking or activities which generate substantial traffic and parking.

Review of Institutional Improvements (Current and Proposed)

The development of institution-related projects currently being developed consists primarily of replacement bed facilities, research labs and parking garages to serve the area's hospitals.

Under Construction

A. Children's Hospital:

Replacement of 280 beds through construction of new in-patient tower.

B. Brigham and Women's Hospital:

Construction of an underground garage for 240 cars and Ambulatory Doctor's Office building of 114,000 sq.ft.

Institutional Development Opportunities/Activities

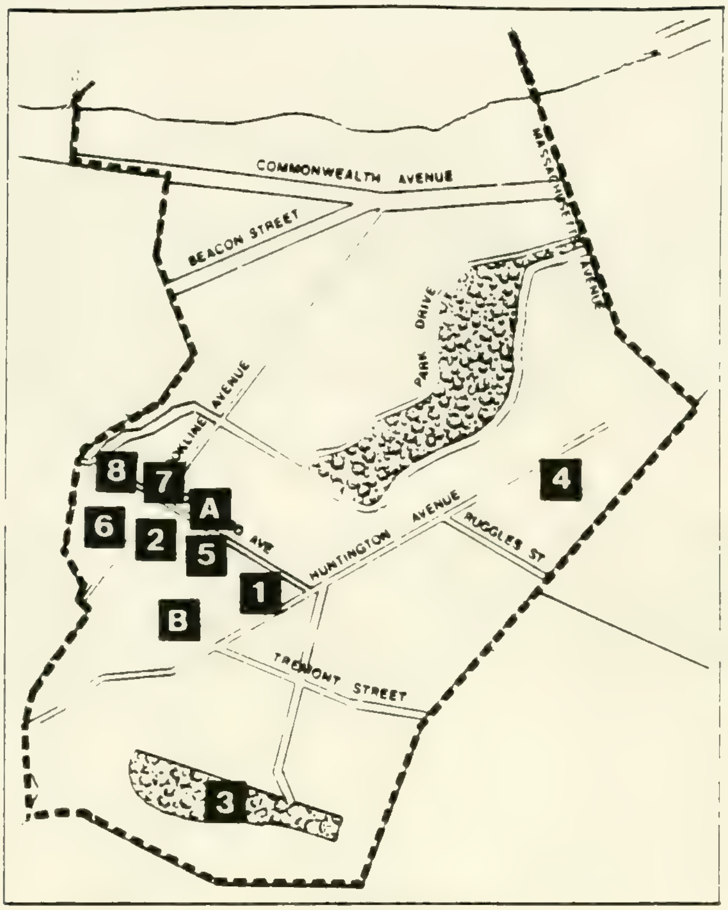
1. Harvard Medical School:

   Addition and renovation of medical school to accommodate up-graded teaching facilities.

2. Dana-Farber:

   Seven story, 100,000 sq.ft. addition including ground floor retail, research and office space.

MAP 8 Institutional Development Activities



A	Children's Hospital
B	Brigham and Women's Hospital
1	Havard Medical School
2	Dana Farber
3	New England Baptist Hospital
4	Northeastern University
5	Children's Hospital
6	New England Deaconess Hospital
7	Mass College of Art
8	Temple Israel/Windsor School

3. New England Baptist Hospital:

   Three story, 130 replacement bed addition and renovation to main buildings.

4. Northeastern University Garage:

   Development of a 5-level, 1000 car garage will be reviewed as part of the Parcel 18+ Advisory Committee.

5. Children's Hospital Research Tower

6. New England Deaconess Facilities Upgrading

7. Mass College of Art Redevelopment:

The State will be able to dispose of the Mass College of Art property in another 3-4 years when the college is able to complete their relocation to their new facilities at the former Boston State property. Planning is currently underway to develop guidelines for the re-use of the MCA site. Area medical institutions would like to develop shared facilities at this location.

8. Temple Israel/Winsor School:

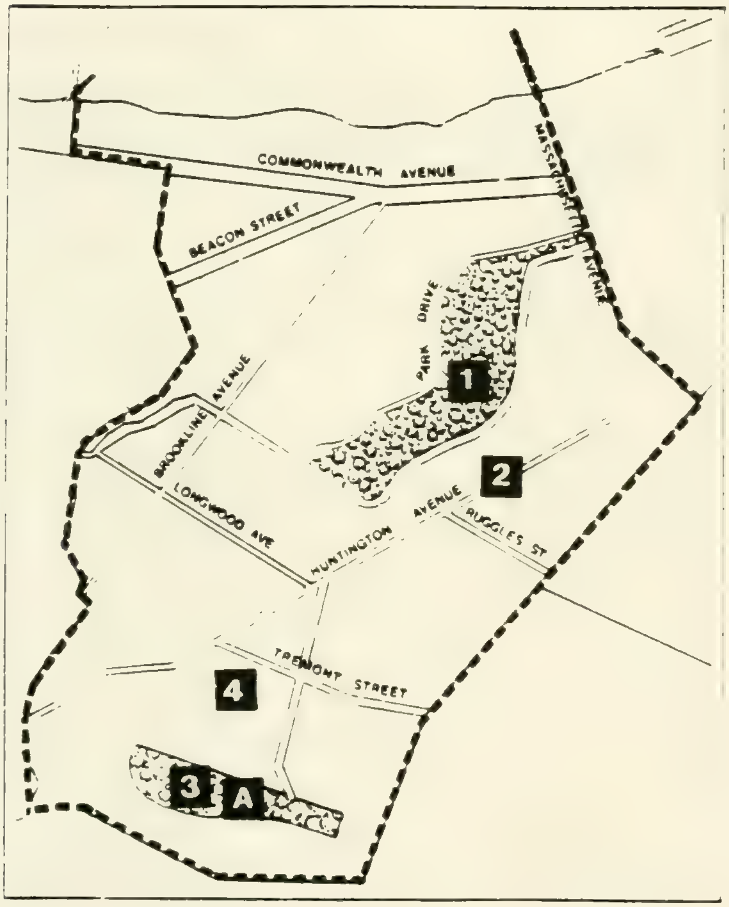
Temple Israel and the Winsor School have reviewed, under the direction of the Medical Area Service Corporation (MASCO), consultant guidelines for the development of their property bordering on Longwood and Brookline Avenues. A mixed-use garage/commercial/possibly housing site is under consideration.

E. Open Space

Background

The Back Bay Fens is one of the City's major open spaces and one of the most important amenities in the Triangle District. In addition to this regional park facility, a number of smaller open spaces are of importance to the community. Two such areas, the field adjacent to McLaughlin Playground and the Quarry site are owned by area institutions (New England Baptist Hospital and Harvard University respectively). Various residents would like to see portions of these sites permanently reserved for opens space purposes.

MAP 9 Open Space Improvement Opportunities



A McLaughlin Playground

1 Back Bay Fens

2 Open Space Partnership

3 Mission Field

4 Quarry Site

Review of Open Space Improvements (Current and Proposed)

Under Construction

A. McLaughlin Playground:

A $365,000 renovation grant provided through the State Land and Water Conservation Fund and the City's Neighborhood Development and Employment Agency is being used to renovate the tot lot and ballfield as well as provide for new fencing and planting.

Open Space Development Opportunities/Activities

1. Back Bay Fens:

Plans are currently being prepared for upgrading the Fens under a special grant celebrating Olmsted's 100th birthday. The $1 million grant is currently being used in part to retain a master planner who will identify a first phase program. In addition, area institutions such as the New England Deaconess have agreed to maintain portions of the park adjacent to their facilities.

2. Open Space Partnership:

A newly formed public/private open space partnership plans to work with agencies and institutions along the Huntington Avenue, from Massachusetts Avenue to Brigham Circle to upgrade these urban open spaces.

3. Mission Hill Field:

The field located adjacent to the McLaughlin Playgound is owned by New England Baptist.

4. Quarry Site:

The quarry site mentioned previously under housing opportunities may also be developed in whole or in part for open space objectives.

MISSION HILL

NEIGHBORHOOD PROFILE

Mission Hill

The Mission Hill neighborhood, immediately adjacent to the southeast side of the LMA and across Huntington Avenue, is a culturally, economically, and racially diverse community comprised of approximately 10,000 people. Three major subsidized housing projects, the Mission Main and Mission Extension, which serve lower income residents, and the Mission Park Development, which contains both subsidized and market rate apartments, are located in Mission Hill. Three large market-rate high-rise apartment buildings are also located in this area. The balance of the housing stock consists primarily of two and three family residences. The neighborhood also includes one primary business district, located at Brigham Circle, adjacent to the Brigham and Women's Hospital. The community is proceeding toward the establishment of an Interim Planning Overlay District (IPOD), after which comprehensive planning and zoning analyses will take place.

With its spectacular views and proximity to downtown Boston, Mission Hill remains a highly desirable residential area.

I. Introduction/Summary

Mission Hill is one of Boston's most unique neighborhoods. Focusing on Parker Hill, the second highest point in the City of Boston, two and three family frame structures share an uneasy co-existence with the largest hospital complex in New England. This residential/institutional conflict is common in many of Boston's neighborhoods, but nowhere is it as complex and concentrated as in the Mission Hill neighborhood. Parking, traffic, institutional expansion, and pollution are but some of the concerns held by the residents of the neighborhood in regard to the Medical Center Area.

The residents of Mission Hill are a heterogeneous mix of low and middle income citizens. The district has attracted many young working class residents in recent years drawn by moderately priced apartments and home ownership opportunities. Some residents have been drawn to Mission Hill by its proximity to the Medical Area. These new homeowners and long-time residents of the Hill have been taking advantage of the home improvement and rehabilitation programs offered by the City and the Neighborhood Housing Services operation on Mission Hill. Supported by City improvements such as street lights, sidewalk and street improvements and playgrounds, streets like Delle Avenue are becoming attractive urban residential settings.

With the construction of the Southwest Corridor Project, new Orange Line rapid transit and Amtrak passenger lines, Mission Hill will receive new transportation service. The Corridor project will also remove the blighting influence of the vacant Corridor site with the construction of a regional park and trail along the Corridor right-of-way. Opportunities for new development will be available adjacent to the new stations, Roxbury Crossing and Ruggles Street, and along the Corridor itself.

Mission Hill contains, or is immediately adjacent to, over 3,500 units of subsidized housing. 2,700 of these units are in the three aging public housing projects, Bromley-Heath, Mission Hill and Mission Extension. While new efforts are being made by the Boston Housing Authority at Mission Hill (main) and Extension and through the Tenant Management Corporation at Bromley-Heath, these projects remain as high priority problems for the neighborhood. More funds should be provided by the federal government for renovation and maintenance and continued initiatives should be made to involve tenants in the planning process. This planning process should result in a master plan for each project. Issues such as security, site design and maintenance should be dealt with in this process.

Past public investment in Mission Hill has focused on the rehabilitation of the public and private housing stock available in the neighborhood. In addition, substantial public investment has been made in street improvements to support housing investment

Because of its location and housing stock Mission Hill will continue to attract new residents. Programs that assist the upgrading of the housing on Mission Hill must continue to be the highest priority for City funds

This 1978 Mission Hill profile is intended to assist the residents of Mission Hill and others by describing the issues present in the community and the current plans and proposed strategies being used to deal with those issues.

II. District Profile

A. EXISTING COMMUNITY NEEDS

1. Total District

a. Population and Income Characteristics

The composition of people in Mission Hill has shifted in the last 20 years from a closely knit, Irish Catholic, family residential neighborhood to a heterogeneous community of 21,000 people. It is now a multi-ethnic community that in 1970 was 76% white, 17% black and 7% Hispanic. However, over half of the Mission Hill families below poverty level, 70% of the black population and 52% of the Hispanic population, are in the Mission Hill Projects area which contains only 25% of Mission Hill's total population.

Mission Hill is housing an increasing number of students and young professionals; a 1972 market study conducted by Robert Gladstone and Associates indicated that demand for housing is found in all price ranges and all income levels in Mission Hill. Specifically, there is a demand for smaller units created by student growth in the area and a demand by an increasing number of professionals (such as physicians and professors), many of whom desire to reside as close to their work as possible.

While Mission Hill contains the largest concentration of medical and educational institutions in the City, most of the employees reside outside the district and the 1970 median family income in Mission Hill was $8,400 and is slightly below the City-wide median of $9,133 (1970).

b. Housing

In 1970, 42% of Mission Hill's residential structures were owner occupied. While some distortion of these figures occurs because of the public housing project areas and the Medical Center area, Mission Hill is well below the City owner-occupancy rate of 72%. Only the Triangle Area with 74% exceeds this rate at the Top of the Hill follows with 64%.

The relatively low rate of owner-occupancy creates the traditional problems inherent with absentee-owners, such as lack of maintenance, etc. These problems are less severe than other areas of the City, however. A 1974 survey by the Boston Redevelopment Authority (excluding units in the Mission Hill Projects) found that 70% of the housing units were in good condition with minor repairs required, 25% were in fair condition with moderate repairs required and the remaining 5% in poor condition.

The Mission Church has long been a center of community life on Mission Hill

c. Commercial and Institutional Areas

The economic life of Mission Hill is dominated by the institutions of the Medical Area and other educational facilities. While these institutions represent an important employment and service resource to the neighborhood and the City, the problems caused by their density have a great impact on the neighborhood.

The continued reliance on the automobile by employees and visitors has created a situation of critical proportions. Parking, circulation and pollution problems grow daily. New parking structures are proposed in order to ease the pressure on residential streets; however, the construction of new parking facilities may only serve to draw new traffic into the area and exacerbate the problems which now exist.

The Medical Area contains fourteen medical institutions, five colleges, three public schools and a temple, as well as a limited amount of housing and retail space. The high density of these uses should be viewed in a positive light as well. Community/institutional cooperation on issues such as recreational facilities can relieve pressures caused by the effects of inflation and declining Federal assistance to the City.

The neighborhood commercial area at Brigham Circle and along Tremont Street provides many needed services to the community. The business district is in need of renovation and improvements in traffic circulation through the Brigham Circle intersection.

City involvement in the business district must depend upon cooperative actions and efforts to be made by property owners and business owners.

d. Transportation

Mission Hill is served by the Arborway branch of the Green Line trolley system. Service to Brigham Circle is adequate; however, passengers are forced to wait exposed to both the elements and traffic hazards on a small reservation in the center of Huntington Avenue. The Mission Hill Planning Commission has recently begun the "Mission Link" shuttle bus service from Brigham Circle to other areas of the Hill. Funded in part by the City's CDBG funds and the institutions on the Hill, the service will be of special value to the neighborhood's elderly citizens.

New transit service to Mission Hill will become available with the construction of the Orange Line through the Southwest Corridor. Stations will be constructed at Roxbury Crossing (Tremont Street) and Ruggles Street. The project is expected to be completed in 1984.

e. Community Facilities and Public Improvement Needs Existing Open Space

Mission Hill/Medical Center Planning District currently contains approximately 44.86 acres of public open space. This provides only an average of 2.18 acres/1,000 which is well below the goal of 5 acres/1,000 established for each neighborhood. How-

ever, Jefferson Playground and Olmsted Park are located at the southern boundary and the Back Bay-Fens forms the northwestern boundary. Thus these sites serve Mission Hill/Medical residents as well. The district is well provided with passive recreation space. Both Evans Park and the 28-acre Riverway which runs the entire western boundary of the district, and 3 smaller landscaped squares provide this type of space.

Active recreation space is limited within the neighborhood. Only 2 of 7 sites, Mission Hill and Park Hill Playgrounds provide active recreation facilities, and as a result, both sites are heavily used. Of these 2 sites, Mission Hill was found in fair condition while Parker Hill was good. The passive sites were all found in good condition.

f. Special Facilities

The Boston Parks and Recreation Department maintains 2 indoor recreation facilities, Tobin Municipal Building and Mission Hill Extension. A skating rink, Kelly Rink, is provided by the MDC on the Riverway near Brookline Avenue. Mission Hill is one of only 2 planning districts which does not contain at least one swimming pool. The Hennigan Community School pool, however, is located just south of the district, and partially serves Mission Hill/Medical Area residents.

2. Mission Hill: Sub-Areas and Neighborhoods

Information on population, income and housing in this report is derived from the 1970 U.S. Census. The 1970 data for Mission Hill is available on a sub-area basis and for purposes of analysis, seven sub-areas have been designated as shown on the sub-area maps. These sub-areas conform in general to Mission Hill Planning Commission and local neighborhood association boundaries, but vary in some instances to conform to Census boundaries for purposes of data analysis.

a. Back of the Hill

The Back of the Hill is a residential area of approximately 540 people. In 1970, the population was 84% white, 14% black, and 2% Hispanic. The housing stock is predominantly two and three family frame dwellings (96%) with only 3% of the stock in single family homes.

The "meadow" on the top of Mission Hill should be preserved as community open space.

The area includes over 20 acres of vacant land, primarily owned by Lahey Clinic and the Ruggles Baptist Church. Over the past ten years, approximately 150 housing units have been removed by these institutions. Typically, residential buildings were acquired, no major investments made, and demolished as soon as they became vacant or uninhabitable. Redevelopment of this vacant land and preservation of the existing residential structures are major concerns of the City and neighborhood residents. The Back of the Hill Community Development Association working with the Greater Boston Community Development Corporation have developed a proposal of 500 units of subsidized housing for the reuse of this vacant land. The proposal is currently being reviewed by City and other agencies.

Other issues of concern are institutional traffic and parking and the poor condition of the Bromley-Heath housing project.

b. Delle Avenue/Terrace

The Delle Avenue/Terrace neighborhood is a residential area of approximately 1,200 people but also contains the majority of Mission Hill's manufacturing and industrial uses. I 1970, the population was 59% white 17% black and 24% Hispanic. The housing stock is primarily (76%) two and three family wood frame structures with 17% of the stock in single family structures.

The neighborhood will be impacted by the relocation of the Orange Line and the proposed station at Roxbury Crossing. Other issues of concern are housing problems, including blight and reuse of the vacant land in the Southwest Corridor

c. Medical Center Area

The Medical Center Area [illegible] use almost exclusively devoted [illegible] hospital and educational institutions. [illegible] 1970, the population was approximately 4,800 and was 97% [illegible] 3% black. In 1970, the area had about 76 residential structures, [illegible] of which were owner-occupied. The institutional use of this area has significantly impacted Mission Hill's residential neighborhoods, and a major concern of the City and the neighborhood is the need for effective control of institutional expansion

d. Mission Hill Projects

The Mission Hill Projects area contains the Mission Hill Main and Mission Hill Extension public housing projects, other residential structures

and some industrial uses. In 1970, the population was 5,138 and was 38% white, 48% black and 14% Hispanic.

Containing over 1,611 units the two public housing projects contain over half the structures in the area and over three-fourths of the units. The poor condition of the projects is a major concern in the area and in Mission Hill as a whole.

Other concerns focus on the impact of the Orange Line relocation and proposed stations at Roxbury Crossing and Ruggles Street. Industrial and institutional land uses are also a concern.

e. The Roxbury Tenants of Harvard (RTH)

The RTH neighborhood is a residential area of approximately 1,600 people. In 1970, the population was 84% white, 11% black and 5% Hispanic. The housing stock is primarily two and three family wood frame structures with 1% of the stock in single family structures and about 25% of the stock in masonry multi-family structures.

This is an area where institutional land banking occurred in order to accommodate future expansion. The RTH group, composed of tenants in Harvard owned buildings, organized during the 1960's to challenge the expansion plans of Harvard University and the Affiliated Hospitals Center. RTH subsequently elicited Harvard sponsorship for the exterior rehabilitation of the two and three family homes along Francis Street and Fenwood Road and has received Section 8 subsidies to facilitate interior rehabilitation.

The Mission Park development was completed in 1977 and contains 775 units of subsidized and market-rate housing. This has brought a new look to this area as well as many new residents.

f. The Triangle Area

The Triangle Area is a residential neighborhood of approximately 1,500 people. In 1970 the population was 88% white, 7% black, and 5% Hispanic. The housing stock is primarily (75%) two and three family structures with 17% of the stock comprised of one family structures. Residents of the 668 units in the three high rise structures along St. Alphonsus Street are more transient than the rest of the neighborhood and constitute a distinct segment of the community. This neighborhood has the highest owner-occupancy rate (74%) in Mission Hill.

The Mission Park housing development has integrated a variety of housing types into the fabric of the community

This area, as well as the RTH neighborhood, is one of the residential neighborhoods most heavily impacted by institutional use and expansion in the Medical Center Area. Although the medical institutions have pledged not to expand on the eastern side of Huntington Avenue, previous years have seen conversion of residential units to institutional uses and the neighborhood still suffers under heavy institutional traffic and parking as well as traffic and parking associated with the Brigham Circle business district. A resident parking system will be implemented by the City in order to remedy one aspect of this situation.

The Brigham Circle business district continues to provide many needed services and goods to the Mission Hill community. While the vacancy rate is low, the area is in need of visual improvement. A growing commercial area along Brookline Avenue is of concern to Brigham Circle area merchants and residents.

Since 1968 numerous public investment have been made in Mission Hill such a these sidewalks

g. Top of the Hill

Top of the Hill is a residential neig borhood of approximately 5,800 pe ple. In 1970, the population was 90 white, 6% black and 4% Hispanic. The housing stock is primarily (77% two and three family wood frame structures.

The New England Baptist Hospital (NEBH) and the Robert Breck Brigham Hospital (RBBH) are the major institutional uses within this neighbo hood. The New England Baptist Ho pital has recently begun extensive di cussions with neighborhood represen atives to coordinate its future plans. Other issues of concern in the neighborhood are residential disinvestmen inadequate water pressure and traffic congestion and parking attributed to employees, patients and visitors to NEBH and RBBH.

B. PAST MAJOR PUBLIC INVESTMENT (1968-1977)

Since 1968, the major thrust of the City's Neighborhood Improvement Program has been in strengthening neighborhoods through the construction and renovation of community facilities and parks, reconstruction of streets, and replacement of sewer and water lines.

. Appendices

. NEIGHBORHOOD HISTORY

ission Hill, once part of the town f Roxbury, was annexed to Boston n 1867. The earliest settlements were arm estates dating from the Colonial eriod and they determined the charcter of the area until the 1860's. In he period from 1860-1880 streetcar ervice and sewage systems were exended to Mission Hill and induced he first major increase in population. cattered housing was built on the lopes of the Hill and German famies who worked in the local brewries settled around the base of the ill. Mission Church was founded in 869 and the existing stone church as constructed in 1878 to replace the riginal wooden building.

rom 1885 to 1895 Mission Hill exerienced a building boom that inolved the construction of a large umber of low cost frame houses. uring this decade, new streets opened and public transportation shifted from the horse drawn car to an electric car line, which by 1894 was in operation along Huntington Avenue and in 1899 extended along Brookline Avenue. By the end of the century, Mission Hill had become a homogenous Irish-Catholic community.

Before 1900, the Convent (House of Good Shepherd), New England Baptist Hospital and the Martin School were the major institutional uses in Mission Hill. After 1900, institutions moved from their downtown locations to the Mission Hill/Medical Center Area due to their need for larger facilities and because of the availability of low priced vacant land accessible to public transportation. In the period from 1905-1926, the great majority of medical and educational institutions in the area completed their initial construction with most of the hospitals being built on the 26 acre site Harvard purchased from the Francis estate.

From 1926 until the present, Missi Hill has experienced extensive instittional construction and limited residential construction. The Medical Center Area has undergone a continuous expansion of medical and educational facilities with the predominant mode being an increase i density on already established sites but with some expansion involving the demolition of residential buildi and the use of other non-institutio property. Residential development, the other hand, has been limited a concentrated in three major areas: Mission Hill Main and Extension; public housing projects completed 1940 and 1952 and containing 1,61 units; (2) Whitney Redevelopment Project (Charlesbank Apartments, Back Bay Manor and Franklin Sq Apartments), Mission Hill's only r development project, completed in 1965 and containing 600 non-subsiized units and (3) Mission Park, a publicly subsidized mixed income project containing 775 units.

LONGWOOD MEDICAL AREA

PROFILE

The Longwood Medical Area ("LMA") is one of the most successful medical and educational complexes in the entire world. It is situated on former large estates which were homes to some of Boston's most prominent families. The area developed as streets and roadways were constructed, streetcar lines were extended, and marshlands and swamps were filled. From those beginnings in the late 1800s and early 1900s, the Longwood Medical Area has become a leading center of patient care, research and education.

Its institutions, their prominence, and their consistent growth speak to the success of the institutions themselves. The Harvard Medical School was the foundation of the area's development and is one of the worldwide leaders of medical education and research. The Brigham and Women's Hospital, Beth Israel Hospital, Children's Hospital, New England Deaconess Hospital, and Dana-Farber Cancer Institute are all leading clinical and patient care centers that are also at the forefront of medical research advancement. They are major recipients in research funding from the National Institutes of Health (NIH) and other primary funding sources. As an example of the Medical Area's prominence, 40% of all NIH funding received by the Commonwealth of Massachusetts is obtained by Medical Area hospitals. Four of the top seven hospital recipients of such funding on a nationwide basis are located in the Medical Area (six of the top seven are Boston hospitals), and only five (5) states in the

entire country receive more research funding than the LMA -- with one of those states being the Commonwealth of Massachusetts.

With this prominence has come the demand for further growth. Over the next ten year period, it is estimated that an additional 3.9 million square feet of new or renovated space will be constructed, primarily for patient care and research space, but also including office space, parking, and educational classroom space.

Currently, the Longwood Medical Area is comprised of just more than 11 million square feet of building space in addition to 7,500 parking spaces. Twenty-six thousand (26,000) individuals work there on a daily basis, and 100,000 inpatients and 1,000,000 outpatients utilize the medical institutions on an annual basis. In addition, 10,000 students attend schools located in the Medical Area.

To accommodate such growth, while at the same time ensuring that the quality of the area is maintained, it is vitally important that the City of Boston, the Medical Area Service Corporation (MASCO), the Longwood institutions, and the neighboring communities of Mission Hill and The Fenway undertake a comprehensive process to plan its management.

New growth, spurred by the demand for research space, medical office space, new patient beds or other uses, necessitates that all future development fully addresses and mitigates the impacts of such growth on an area-wide basis. To properly do so,

the Boston Redevelopment Authority and MASCO have developed a Master Plan for the Longwood Medical Area to guide and manage future growth. This Master Plan defines development policies and guidelines for all major issues, with particular emphasis on transportation and urban design, two major concerns of future growth in the area.

Transportation concerns are of particular importance. With current levels of activity, several major intersections now operate at unacceptably low levels of service during peak times. With significant growth anticipated for the 1990s, traffic could further aggravate this already difficult situation. The vitality and success of the Medical Area in the next decade depends upon its ability to circulate visitors, patients, students, and employees in and out on a daily basis, while providing nearby residents with access to adjacent residential areas.

Urban design issues are of equal importance. As the Medical Area has expanded over the past several decades, it has been guided by few urban design principles for the entire LMA. Development has occurred on a project by project basis, with no overriding design objectives. In order to maintain and enhance the area's urban design character, particularly as it relates to building design, pedestrian access, open space, and other components of the design system, guiding principles will be vitally important.

Of additional importance is the Medical Area's geographical location within the city between two (2) older residential neighborhoods -- Mission Hill and The Fenway. Both communities have experienced the impacts of past growth, but have not received equal benefits. It is therefore critical that future development help to minimize the negative impacts growth may have on these communities, and to maximize the potential benefits of such growth.

The purpose of the Longwood Medical ("LMA") Master Plan must be to guide growth and development within the area over the next 10 years such that the missions of the LMA can continue to be undertaken while the adjacent neighborhoods, specifically the Mission Hill and Fenway communities, are not negatively impacted, and in fact can benefit from such growth.

The overall objectives of the Plan are:

- To provide for the development of the area in a fashion which will allow the LMA to enhance its position as one of the country's leading clinical, research, and educational centers.

- To provide for the continued expansion of research space, thereby enabling the area to continue to thrive as a premier research center and maintain Boston's stature as the leading medical research center of the nation.

- To create an urban design image for the area which will provide a positive identity to the area's physical environment.

- To promote residential and commercial land uses which will diversify the LMA environment and provide for 14 to 16 hours of daily street activity.

- To create new open space and an attractive pedestrian environment for all users.

- To generate new permanent and construction employment opportunities for Boston residents.

- To generate economic, health care, and educational benefits resulting from LMA growth for adjacent residential neighborhoods.

- To improve the overall traffic flow and circulation patterns within the area.

B. HISTORY OF THE LONGWOOD MEDICAL AREA

Early Development: 1730-1900

The Longwood Medical Area is located on 150 acres which were the former site of Boston's largest estates during the early 1700s. Farming settlements here in the 1730s in the southern half of the area, called the Uplands and Punch Bowl Tavern areas (see attached map). The Muddy River and its adjoining marshes and

swamplands occupied what is now the central portion of the Medical Area. During this time period, the land was a part of the towns of Brookline and Roxbury.

These farm estates and nearby marshlands became potential sites for more intense development when road construction took place during the early 1800s to connect Boston to Brookline and other growing western settlements. New roadways included Punch Bowl Road (Brookline Avenue) and Francis Street, which were built in 1830; Mill Dam Road (Beacon Street), built in 1827; and Parker Street and Tremont Streets, both constructed in 1836. Estates of twenty to thirty acres were subsequently established by those families wealthy enough to support farming within this emerging urban environment between Brookline and Boston. This land use pattern framed the physical future of the area. Property lines from many of these estates can still be identified today by existing street patterns.

Between 1850 and 1900, further development potential was encouraged by several major events, including the Back Bay Landfill Project of 1858-1882; Boston's 1867 annexation of the area, which had been part of the town of Roxbury; the continuing development of a roadway network; and the advent of public transportation.

Residential development adjacent to the established estates was steady and consistent during the 1870s and 1880s as speculators saw opportunity for profit in the City's formalized westward expansion. A grid pattern of streets was established to support this residential growth. Longwood Avenue and Pilgrim Road, for example,

were built during this time period to connect Huntington and Brookline Avenues, and to service residential development around Francis Street and along the Muddy River.

In the 1890's residential development increased substantially with the completion of the Back Bay Landfill Project and the beginnings of public transportation. Electric trolleys were in operation along Longwood and Huntington Avenues by the middle of the decade, and along Brookline Avenue by the decade's end, making this area as accessible as any neighborhood outside of the downtown. The Riverway and The Fenway roadways were also constructed during this period, framing the grid pattern for the growing residential area between Brookline Avenue and The Riverway and the area surrounding Francis Street.

A subdivision plan was proposed in 1895 by Fredrick Law Olmsted to establish a complete grid system for residential development within the landed estates in order to manage future residential growth. That plan, however, was never implemented.

Institutional and Residential Growth: 1900-1950

Institutional development began between 1900 and 1930, which together with residential development furthered the development of the area. This period of large-scale development began the process of solidifying present day land use patterns which fully emerged over the subsequent decades. Most development throughout this period took place during two development booms which lasted two years each.

Educational development initiated the first phase of institutional growth in 1905 and 1906. Educational institutions began to leave the inner city because of its increasing congestion, as well as rising costs and the limited supply of land. The availability of both land and public transportation made the Longwood area attractive for such growth. As a result, Wheelock College, Simmons College, Farragut School, Girls Normal School, and the Latin School established their campuses in this area, as did the Gardner House and Museum. In 1906, after finalizing an arrangement with the executors of Peter Bent Brigham's will, Harvard University purchased twenty-six acres of the Francis estate and began to build its medical school on eleven acres. Harvard set aside the remaining land for an associated relationship with Brigham Hospital. Between 1905 and 1920, the balance of the educational institutions now located in the area arrived, with Emmanuel College, the Winsor School, Mass. College of Pharmacy, and High School of Commerce, in addition to the Angell Memorial Hospital, establishing themselves during this fifteen year period.

Encouraged by the development of Harvard Medical School and the land set aside for medical uses, hospitals initiated the second institutional development boom during 1910 and 1911. Peter Bent Brigham Hospital, Children's Hospital, Deaconess Hospital, Huntington Hospital, Roch Hospital for Infants, and the Massachusetts Mental Health Hospital all were developed around the Harvard Medical School campus during this time period. The Deaconess and Mass. Mental Health Hospitals were the only two hospitals not built on Harvard's Francis estate lands.

The development of Boston Hospital for Women in 1921 and Beth Israel Hospital in 1925 generally completed the arrival of major medical institutions in the area.

Throughout this period of educational and medical growth, residential development continued as well. Public transportation and the remaining available land made the area attractive for residential development. More than 900 units of mostly middle class row houses and two-family dwellings were built between 1900 and 1910, primarily to the south of Francis Street, thereby completing the development of land in the Francis Street area. Housing was also constructed along Brookline Avenue and on parcels adjacent to the river. Three hundred and eighty apartments were built on the west side of Brookline Avenue from 1920 to 1930, virtually completing all residential development in the area.

Road construction during this time period solidified the present transportation patterns. The residential grid within the Francis Street area was completed and remains today. Roads were developed in cooperation with various institutional developments. Avenue Louis Pasteur, for example, was constructed in conjunction with the Harvard Quadrangle to form a neoclassical landmark for the area.

Vila Street (Blackfan) and Van Dyke Street (Shattuck) were planned and constructed by the City of Boston to further define a grid pattern. Vila Street stretched from The Fenway through Longwood Avenue and Francis Street to The Riverway, while Van Dyke provided access from The Riverway to Huntington Avenue. These streets

eventually conflicted with institutional desires and have been closed in part over the years. Brigham Hospital closed its section of Vila Street as early as 1913. Since that time, no new street additions have been constructed in the area, with the exception of the Binney Street extension.

By 1930, present land use patterns for housing, education, and medical care had been established. Temple Israel was built in 1921 and the Mass. College of Art was developed at the intersection of Longwood and Brookline Avenues in 1929, for the most part completing the development of large tracts of land.

Institutional Growth: 1950-1990

Since 1950, institutional growth has been consistent and substantial, while residential development has virtually stopped, with the exception of the Mission Park housing complex, which was completed in 1975. Institutional development -- particularly, health care-related development -- has been undertaken on an increasingly large scale within established campus boundaries, as well as through acquisitions of adjacent non-hospital properties.

Institutional development, primarily health-care related, has increased steadily during recent decades. One million square feet was constructed during the 1950s. Two million square feet was developed during the 1960s. During the 1970s and 1980s, almost three million square feet was developed each decade. By the end of 1989, more than twelve million square feet existed, the majority built since 1950.

Development of educational facilities occurred most through the 1960s and early 1970s, dropping off almost completely thereafter. This expansion occurred mainly on existing campuses, although a portion took place when institutions acquired non-institutional land on which to expand, such as the development by Simmons and Emmanuel Colleges along Brookline Avenue. Major educational buildings became a part of the skyline when Boston English High School was constructed in 1970 and Boston State College was built in 1977.

This upward and outward growth pushed institutional boundaries closer together and created large separate and distinct campus environments with individual identities. Institutions developed the perimeters of their campuses to create informal quadrangles of open space within them. Campuses in effect became walled off, limiting the internal access among them. Streets were closed to develop these private, internal campus environments. Blackfan Street, for example, was closed within the Emmanuel campus in the 1950s. A portion of Pilgrim Road within the Winsor School campus was closed as recently as the 1980s. While viewed by the institutions as campus improvements, all had the effect of further restricting pedestrian and vehicular access within the area.

Hospital and medical-related growth have followed similar growth patterns, but on a much larger scale. Specialized treatment centers, outgrowths of the existing medical institutions, were the principal new additions to the area between 1945 and 1956.

These included the Jimmy Fund, followed by what is now known as the Dana-Farber Cancer Institute, the Joslin Diabetes Center, and the Judge Baker Childrens Center.

Consolidation of existing hospitals in the area was a significant change during this time period as well. The Brigham and Women's Hospital is the result of a merger between Boston Lying-In Hospital and the Free Hospital for Women, and its eventual merger with the Brigham hospitals in 1974.

The New England Deaconess Hospital joined the other major hospitals through affiliation with the Harvard Medical School in 1977. All hospitals and clinics in the area are now a part of the Harvard teaching mission.

Growth in medical research and patient care services, however, has been the central feature of development during this time period. This growth has consisted primarily of expansion within original campus boundaries. Older buildings were replaced, new structures were built, and development was pushed to the boundaries of each institutional campus in order to meet growing space demands. The maximization of land use became the critical factor of development. Surface parking lots became valuable areas for new development, and were converted to either developable sites or structured garage parking to meet space needs. Open space became more limited and restricted as well.

The acquisition of additional land for expansion also occurred during this time period. Streets were closed to meet growth needs and, like educational institutions, to enhance internal access and identity. The Deaconess Road connector to the Riverway, Blackfan Street on the Brigham and Women's campus, the Shattuck Street connector to Huntington Avenue from the Harvard Medical School, and Wigglesworth Street on the Harvard campus were all closed by 1955. Since that time, Blackfan and Shattuck Streets have essentially been closed as streets, although a remaining part of Shattuck Street is presently being redeveloped as a service alley and pedestrian mall.

Development of non-institutional land also began to occur and initiated community conflict with the medical institutions over the MATEP power plan. The construction of the plant, necessitated the removal of a block of residential housing, causing community conflict which endured for years. Mission Hill residents became concerned that institutions would attempt to acquire other large tracts of land within their community for future expansion, as was occurring in other parts of the city.

Today, the Longwood Medical Area is faced with these continuing development pressures as medical and educational institutions plan for future growth. The demand for additional research and patient care facilities continues to grow and the need for institutional expansion remains. Increasingly dense development, however, has brought about more complex issues that challenge this area's future. Transportation, environmental quality, security, open space, urban design, the availability of housing, employment opportunities and neighborhood relationships are issues that will

accompany this next phase of the area's development. The direction of future development and its impacts will require collective, cooperative planning. The ability to meet these expansion challenges together will ultimately define the future of the Longwood Medical Area.

CHAPTER III - THE PLAN FOR THE LONGWOOD MEDICAL AREA

A. THE PLANNING CONTEXT

1. The Institutions and Their Preeminent Role

The Longwood Medical Area (LMA) is known throughout the world for its preeminent leadership role in medical care, research, education and the arts. Located in the heart of Boston, nineteen medical, academic, and cultural institutions occupy and define this area. Of these nineteen, five are hospitals, two are medical centers, three are professional schools of Harvard University, five are colleges, and the balance includes a preparatory school, a public high school, a museum, and a temple.

Medical care and research dominate the landscape of the LMA. Boston, of course, is equated with outstanding hospitals which, in large part, reflects the prominence of the LMA. The names are known throughout the world: Beth Israel Hospital; Brigham and Women's Hospital; Children's Hospital; Dana-Farber Cancer Institute; and New England Deaconess Hospital. In addition to these major teaching hospitals are the Joslin Diabetes Center, and the Judge Baker Children's Center, both nationally recognized for their individual medical accomplishments. Together, these institutions provide specialty care, conduct research and offer teaching programs that are of the highest quality in the world. With the exception of the Judge Baker Children's Center, all are Harvard-affiliated teaching institutions.

These institutions provide leadership for clinical care, research, and teaching, creating a unique environment which results in tremendous medical and scientific advancement. This critical mass of the world's finest practitioners, scientists, and students provides a dynamic interaction on a daily basis. The LMA is a complex which discovers and teaches "tomorrow's routine practices" under the highest quality of medical care.

Clinical Care

Clinical medicine is the foundation of the Medical Area. The 2,080 hospital beds and 184 bassinets located within the five hospitals represent over 30 percent of all short-term care beds and over 60 percent of all bassinets within the City of Boston. Inpatient admissions number over 100,000 annually; outpatient visits total over one (1) million annually; and almost 16,000 deliveries are performed in these hospitals each year.

Patient demand for the care and services of these institutions is obviously substantial. The combined average bed-occupancy rate is close to 83 percent, well above the city-wide average of 77 percent and, by hospital standards, generally considered to be at or near full capacity.

Each of the LMA hospitals is noted for its excellence in particular areas of clinical medicine, from obstetrics and cardiology to cancer and AIDS treatment. People travel from all over the world for this specialty care. Yet LMA hospitals also serve as

important local and regional centers for health care. The majority of patients, both rich and poor, come from Boston and the New England area. In 1989, LMA institutions provided approximately $70 million in uncompensated care -- or roughly seven percent of their total patient service revenues -- through service to the community at large.

Medical Research

Medical research provides the building blocks for clinical medicine advancements. Research leads to advances in medical knowledge and practices which, in turn, improves clinical care. In addition, the presence of research talent and space attracts the most talented researches and practioners from around the country to Boston and the Medical Area.

The LMA is an unparalleled leader in medical research in the country. The largest source of funding for medical research comes from the National Institutes of Health (NIH), and four of the top seven recipients of NIH grants to independent hospitals in 1989 were LMA institutions (six of the top seven were Boston hospitals). Only five states receive more NIH funding than the LMA: California, Massachusetts, New York, Pennsylvania, and Texas. Total NIH funding for institutions within the LMA, including the Harvard Schools, amounted to approximately $250 million in 1989. Medical research provides the foundation for these institutions to increase their efforts in specialty care, strengthen their own clinical programs, and contribute to overall improvements in medical science nation-wide.

Education

At the heart of the LMA medical institutions is their teaching mission. Without new students of medicine and science, and without the constant interaction and discussion of discoveries and ideas by doctors, scientists, and students, medical advancements would be slowed.

Harvard University is world renowned as an educational center for medicine and public health. The five major hospitals and Joslin are affiliated with Harvard. Doctors hold joint appointments with the hospitals and schools, creating the relationship between teaching, research and clinical care. Harvard attracts leading specialists from around the world to serve as visiting members of this community. The teaching component of these relationships creates a synergy that has made this area the world's leader in medical care and research.

The LMA is also known for its preeminent leadership role in other spheres of education. It has long served, for instance, to educate women through special institutions of secondary and college instruction. Simmons College was the first women's college for career education in the country. Emmanuel College was the first Catholic women's college in New England. And Wheelock College, a co-educational institution and the oldest of the three schools, has specialized in preparing predominantly women for careers and professions with children. Simmons and Emmanuel Colleges continue to provide undergraduate instruction to women only, while they now offer co-educational graduate and adult programs. In addition, the

Winsor School provides day school instruction to girls and young women from grades five through twelve. Together, these private institutions provide instruction to approximately 5,000 students, almost all of whom are women.

Education and service in the fine arts is also a special mission within the LMA. The Massachusetts College of Art provides instruction to over 1,000 students. The Isabella Stuart Gardner Museum houses one of the finest art collections in the world. These two institutions are a part of Boston's cultural corridor along Huntington Avenue which includes such nationally recognized names as the Museum of Fine Arts, Symphony Hall, the New England Conservatory, and the Berklee College of Music.

Other institutions within the LMA include the nation's oldest public school, Boston's Boston Latin School, the Massachusetts College of Pharmacy and Allied Health Services, and Temple Israel. These institutions also play a vital role in the mission of this area. The College of Pharmacy is the oldest private school of pharmacy in the country, and educates approximately 1,000 students each year. Together with the larger and more nationally recognized institutions, these members of the LMA community help to diversify the LMA community and its role in healing, teaching and research.

2. The Institutions and Their Economic Impacts

The LMA is a major participant in the Boston economy. Total revenues for the institutions as a group amounted to almost $1.6 billion in 1989. This total is slightly less than the annual revenues of the Polaroid Corporation, the eleventh largest corporation headquartered in Massachusetts and a prominent international company.

A measurement of the LMA's stature in the Boston and state economy as a whole is reflected in the statistic that the LMA is responsible for approximately five percent of the Gross City Product of Boston, which in 1989 was approximately $31 billion, and more than one percent to the Gross State Product of the Commonwealth, which in 1989 was approximately $130 billion. Almost all of this economic activity is centered within the health care institutions.

LMA institutions provide employment to approximately 26,000 people, with the health care institutions accounting for 22,000 jobs and the academic institutions 4,000. These 26,000 jobs represent approximately 4 percent of total employment in Boston, which stood at 628,000 in 1989. Total annual payroll for the institutions amounted to approximately $650 million in 1989, while average salaries for the area were $26,000, well above the city-wide average of $21,500. According to recent surveys, approximately 37 percent of this total labor force are Boston residents, holding 40 percent of all hospital jobs and 25 percent of all jobs within the educational institutions.

Property within the LMA is valued at more than $1 billion, according to the City of Boston Assessing Department, or approximately 20% of all non-governmental tax exempt property in Boston. Although tax-exempt, LMA institutes have contributed to the city's tax base through payments-in-lieu-of-taxes (PILOT). On an annual basis, these institutions pay $275,000. This total represents approximately 1.5 percent of all PILOT payments to the City of Boston.

The Medical Area's institutions have also made substantial contributions to the city's linkage program. The housing and job training linkage programs are designed to assist the city in meeting the needs for affordable housing and employment training for the residents of Boston. The housing linkage program, begun in 1984, requires a payment in the amount of five dollars per square foot in excess of 100,000 square feet for new construction or substantial rehabilitation. Similarly, the job training linkage program, established in 1986, requires a payment in the amount of one dollar per square foot in excess of 100,000 square feet for new construction or substantial rehabilitation. To date, LMA institutions have contributed more than $2 million in housing linkage payments and more than $200,000 in job training funds.

Indirect benefits procured by these institutions are more difficult to quantify, but are still apparent. First, they have combined to create a dynamic medical environment which serves as a catalyst for new research discoveries and growth throughout the city. They collectively enjoy a reciprocal relationship with the other medical complexes in the area. Massachusetts General Hospital, Tufts University Medical School, New

England Medical Center, Boston University Medical School, University Hospital, and Boston City Hospital all interact closely with the LMA institutions to foster the critical mass of medical research. Massachusetts General Hospital, like the hospitals within the LMA, is affiliated with Harvard University. Their collaboration generates medical advances which produces a larger and more effective health services economy. Boston's leading economic role in health care is anchored in the LMA, but reinforced by the presence of all the health care institutions.

This foundation of health care and research within the LMA and city of Boston encourages to the development of private, for-profit industry within the health care field. New England is a world leader in the manufacture and sales of medical equipment. Almost twenty percent of all medical equipment sold in the United States is produced in New England. This market share is attributable to the area's health care talent, where many technological advances in medical equipment are first discovered and developed.

Boston and the immediate area is also emerging as a national leader in the field of biotechnology. This industry is a central component in Boston's transition to new economies. Industry analysts agree that biotechnology will develop around leading medical and academic institutions because of its concentration of research talent. The LMA, through its leadership in medical science, will act as a foundation from which for-profit medical industries will grow and provide Boston and the surrounding area with wide-ranging economic benefits beyond the direct benefits of hospital activity.

3. A Comparative Analysis of the Medical-Academic Complex

The LMA stands alone in terms of its medical prominence, academic esteem, and economic size. Other examples of such medical-academic complexes, however, can be found in other areas of the country. Three complexes in particular resemble the LMA: Johns Hopkins Hospital in Baltimore; the Texas Medical Center in Houston; and the University Circle Medical Center in Cleveland. All are located near a downtown core and situated adjacent to urban residential neighborhoods. All are based on the triad of teaching, research and clinical care. And finally, each complex is of sufficient size to develop many areas of specialization and provide for constant interaction among staff of varying fields of knowledge. Like the LMA, such a large and intensive system creates a continually expanding medical and economic base.

Texas Medical Center

The Texas Medical Center (TMC), located about 15 minutes from Downtown Houston, is in many respects the area most comparable to the LMA. While the TMC encompasses a total of 546 acres on 8 campuses, its main campus is approximately 140 acres, roughly equivalent to the LMA.

Incorporated in 1945, the TMC today claims to be the largest medical complex in the world. The Center is comprised of 41 not-for-profit member institutions, including 11 major hospitals and patient care facilities (with 6,169 total licensed beds), in addition to 9 academic institutions (led by Baylor College of Medicine and the University of Texas Health Science Center). Combined, these institutions employ 54,000 people and

create an annual local economic impact (direct and indirect) estimated at over $8 billion.

The TMC has developed substantially and steadily over the past four and a half decades. In 1986, capital investment in the Center surpassed $1.5 billion, and 1986 - 1992 construction projects for new or existing facilities total $1.35 billion. In 1990, the combined annual operating budget of the TMC was $3 billion. Developments nearing completion within the TMC include Texas A&M's $25 million, 210,000 square foot Institute of Biosciences and Technology, and, on the adjacent Rice University campus, an $18 million, 107,000 square foot Institute for Biosciences and Bioengineering. Other new developments include medical office developments and apartment complexes.

In addition to institutional development, the TMC has been quite active in technology transfer. Baylor College of Medicine, the U.T. Health Science Center, and the U.T. M.D. Anderson Cancer Center have each founded biotech-related companies specializing in products or processes.

University Circle, Cleveland, Ohio

Thirty-eight health care, educational, cultural, and religious institutions today comprise the 600-acre complex known as "University Circle." The origins of the complex, located about 4 miles from Downtown Cleveland, date back to the late 1880s, when large tracts of park land were donated to the City of Cleveland. Case Western

Reserve University, the University Hospitals of Cleveland, and the Cleveland Clinic Foundation are among the most prominent of the 60 institutions which comprise the University Circle community.

Collectively, University Circle (UC) institutions employ more than 15,000 persons. In addition, UC educational institutions enroll a total of 16,000 students. Visitors to the area, including its hospitals, museums, and other attractions are estimated at 2 million annually. Five thousand people live within the area.

Planning for the University Circle community is coordinated by an entity called University Circle Incorporated (UCI). Working with Sasaki & Associates, UCI completed a master plan in November of 1990. The Master Plan is designed to guide physical planning and development within University Circle for a 20 year period. Between 1990 and 1995, the Master Plan calls for $400 million in new institutional development.

Johns Hopkins Medical School and Hospital

Located on the east side of Baltimore, the Johns Hopkins Medical School and Hospital comprises several city blocks. Its approximately 2 million gross square feet of space is distributed among multiple buildings. The Medical School and Hospital are located across town from the balance of the Johns Hopkins University campus.

Dominating the Medical School/Hospital campus are buildings which house research laboratories, teaching facilities, and office space. The predominance of research and academic facilities is explained partly by the fact that John Hopkins is the single largest recipient of NIH research funding in the nation. Affiliated with Hopkins are research programs such as the Kennedy Institute, the Howard Hughes Laboratories, and the Institute for Health and Hygiene.

A master plan for Hopkins Medical School and Hospital was prepared in 1988, in conjunction with planning for the construction of a new medical research building. Since virtually all of the available land on the campus has been developed, the focus of new growth is vertical development. The urban design impacts of proposed vertical growth are among the major issues in current planning efforts.

2. Transportation and Parking

a. Introduction

The planned growth within the Longwood Medical Area will generate new commuter and off-peak trips by the employees and visitors filling the clinical, research and office space to be developed in the future. The roadways serving the area are already heavily used in peak hours, however. Scarce land is already heavily used for parking. The direct extension of current travel and parking patterns to future developments would therefore threaten the capacity of area roadways as well as require further allocation of LMA sites to parking. Unless the travel behavior of the institutions can be modified, the capacity of the area's transportation systems will become a constraint on LMA growth in the future.

The transportation element of the area Master Plan is therefore guided by the overriding goal of limiting the number of peak hour commuter automobile trips generated by the area as a whole. To achieve this goal, its specific objectives are:

- To improve the use of transit and shared vehicles by the area's employees.
- To manage existing and future LMA and off-site parking space so that patients and visitors are adequately served and commuting employees are not encouraged to use single passenger vehicles.
- To improve public transit access to the area.
- To provide systematic circulation improvements which will decrease congestion levels.
- To increase pedestrian and biking access to the LMA area.

The Longwood Medical Area institutions and the City have already developed a number of strategies to achieve one or more of these objectives. It is the purpose of this Master Plan to establish a clear transportation policy framework for the area as a whole, so that these strategies can become elements of a comprehensive transportation program. The transportation and parking practices of each institution can then be judged against the program's goals. Modifications can be required, as necessary, to ensure that the Longwood Medical Area retains the transportation capacity to grow in the future.

b. Existing Conditions of LMA Transportation System

Approximately 26,000 people work in the LMA on a daily basis. In addition, a total of 100,000 in-patients and 1,000,000 out-patients are provided with care on an annual basis, or a total of approximately 5,000 patients and visitors travelling to and from the area on a daily basis. 10,000 students go to school there as well. Total daily two-way person trips, therefore, are approximately 41,000 people.

Of the 26,000 employees who travel to and from the LMA each day, forty percent (40%) do so alone by car. Sixteen percent (16%) carpool with one or more other people. The average vehicle occupancy among auto uses is therefore 1.2 people. Twenty-six percent (26%) take public transit, and the remaining eighteen percent (18%) either ride a bicycle or walk.

Transportation Mode
LMA Employees

	#	%
Auto (1 person)	10,400	40
Carpool	4,160	16
Public Transit	6,760	26
Bicycle/Walk	4,680	18
	26,000	100

Six communities combine to generate sixty-three percent (63%) of all work trips to the LMA. Boston alone generates forty-one percent (41%). The other communities include Brookline, Newton, Cambridge, Somerville, and Quincy. Fifty-eight percent (58%) of this total drive and forty-two percent (42%) use public transit. These six communities account for eighty-three percent (83%) of all transit work trips.

Trip Generation Origins
LMA Employees

Community	%	% Drive	% Transit	% Bike/Walk
Boston	41	57	43	
Brookline	7	60	40	
Newton	6	67	33	
Cambridge	5	44	56	
Somerville	2	62	38	
Quincy	2	68	32	
Total	63	58	42	

Traffic Generation During Peak Hours

According to the 1987 LMA Transportation Study, which was undertaken by the Medical Area Service Corporation (MASCO), only thirty-five percent (35%) of all peak

hour auto traffic within the LMA is medical area-related. The remaining sixty-five percent (65%) is through traffic destined for a different location, but utilizing LMA arterials, primarily Brookline Avenue, Huntington Avenue, and The Riverway. Total automobile traffic flow during peak hours includes the following types of traffic:

Traffic Type	%
Commuter	59
Business	10
Student	9
Medical Appointment	7
Medical Visitation	2
Shopping, Social, Other	13
Total	100

The Riverway and Huntington Avenue are the most heavily travelled through streets during commuting hours. Surveys on The Riverway showed that more than eighty percent (80%) in the a.m. and p.m. for both northbound and southbound travel was through traffic. Huntington Avenue near Brigham Circle showed through traffic at around seventy-five percent (75%) in both directions during the a.m. and p.m. peak times. Brookline Avenue showed heavy through traffic (59% and above) in both directions for the p.m. period, but lower through traffic (37% and above) in the a.m. period.

As a result of both the growth of through traffic and continued institutional development within the LMA, traffic volumes have increased steadily since 1975. In 1987, The Riverway was experiencing an increase of approximately six thousand

(6,000) vehicles per day (vpd) over 1975 levels, an increase of approximately twenty percent (20%). Huntington Avenue north of Longwood and Brookline Avenue south of Pilgrim Road showed increases of approximately two thousand (2,000) vehicles per day over 1975 levels. Francis Street experienced the greatest increase, however, with thirteen thousand (13,000) vehicles per day in 1987 versus its 1975 level of five thousand (5,000). The Francis Street increase is a primary example of new traffic generation created by the construction of two new parking facilities, new hospital construction, and street pattern changes which reduced the driver's travel options. Other streets, such as Longwood Avenue and the area of Brookline Avenue south of Longwood, showed no changes.

Average Weekday Daily Traffic

Street	1975 VPD	1987 VPD	Change
Francis Street	5,000	13,000	+8,000
The Riverway (north of Longwood Ave.)	20,000	26,000	+6,000
The Riverway (south of Brookline Ave.)	33,000	38,000	+5,000
Brookline Avenue (north of Longwood Ave.)	27,000	29,000	+2,000
Brookline Avenue (south of Longwood Ave.)	28,000	28,000	0
Longwood Avenue (east of Brookline Ave.)	12,000	12,000	0
Longwood Avenue (west of Brookline Ave.)	8,000	8,000	0
Avenue Louis Pasteur	8,000	5,000	-3,000

Public Transportation

Public transit and its availability is a vitally important component of present LMA transportation patterns. The structure of MBTA services to the LMA area is that of radial rail lines emanating from Downtown Boston, with bus routes feeding those lines. The rail transit serving the LMA consists of two branches of the Green Line, the Arborway/Brigham Circle (E-Line) and the Riverside (D-Line). The E-Line stops at Forest Hills, a major bus transfer stop. The D-Line provides service to Park and Ride facilities near the I-90/I-95 interchange. In addition the Orange Line and commuter rail provide indirect service to the LMA at Ruggles Station, requiring transfer to a different mode to reach the area.

There are five bus routes directly serving the area:

Bus Route 47 -	Service between Roxbury and Central Square covers most of Longwood and Brookline Avenues.
Bus Route 60 -	Service from Kenmore Square to Route 9, with stops on Brookline Avenue.
Bus Route 65 -	Service from Kenmore Square to Brighton Center with stops on Brookline Avenue.
Bus Route 66 -	Serves Roxbury, Brookline and Allston.

Ridership among the transit and bus lines directly serving the LMA during a typical weekday morning peak hour is as follows:

A.M. Peak

	Total		Outbound	Inbound
Arborway Line	44%	(2,400)	(1,600)	(800)
Riverside Line	16%	(875)	(350)	(525)
Bus Route 47	17%	(900)	n/a	n/a
Bus Routes 60,65,66	14%	(750)	n/a	n/a
Bus Route 8	9%	(480)	n/a	n/a
Total		5,405		

Service hours vary among the rail and bus lines. Green line service on both the Arborway (E) and Riverside (D) Lines runs every ten minutes from 5:30 a.m. to midnight seven days a week. The E-Line, a portion of which is under construction, has a temporary replacement bus (Bus Route 39) that travels this part of the route with the same frequency. Bus Route 47 provides service at ten minute intervals during peak hours. However, during mid-day hours, service is every twenty minutes and drops to thirty minutes during evenings and weekends. Bus Routes 60 and 65 operate less frequently. At peak hours, they operate at twenty minute intervals, while at mid-day, service drops to thirty minute intervals. Route 60 runs every thirty minutes in the evening and runs hourly on Sundays. Route 65 has no evening or Sunday service. Bus Route 8 provides service at twenty minute intervals during peak hours, twenty-five minute intervals during the mid-day, and forty-five minute intervals during the evenings and weekends. Bus Route 8 operates seven days a week.

Bus service is limited in the evening, which impacts second and third shift employees. Bus Route 65, for example, which serves Brighton Center, has no evening or Sunday service, thereby prohibiting its use by second and third shift employees.

The LMA institutions have increasingly recognized the importance of public transit usage to the area. Many institutions now provide subsidies to MBTA monthly passes as part of their benefit packages. The percentage of T pass subsidies in this area currently runs from ____ to ____ percent.

MASCO Transit System -- Metrobus

The MASCO shuttle system, operated through its subsidiary, Metrobus, compliments the MBTA services. This system operates four bus routes (M1, M2, M3, M4) which service off-site parking facilities as well as neighboring communities.

Approximately 2,700 people use the Metrobus service during a typical a.m. peak period, both from satellite parking sites and from their own homes. One thousand nine hundred (1,900) individuals, or about seventy percent (70%) of Metrobus riders, take a Metrobus from satellite parking facilities. Approximately eight hundred (800) people, or thirty percent (30%) of all riders, use this service as a primary source of transportation from Cambridge.

Ridership during a typical a.m. peak time on these services can be defined as follows:

A.M. Peak

	Total
M1	825
M2	825
M3	500
M4	550
Total	2,700

Route M2, which runs to Harvard Square and other Cambridge points along Massachusetts Avenue with passenger pick-up throughout, provides service every ten minutes during peak hours, every twenty minutes at mid-day, and hourly runs at night and on Saturdays.

Routes M1, M3, and M4 provide bus service only to satellite parking facilities. Route M1, which services the Fenway/Kenmore parking area, runs every eight minutes during morning and afternoon peak hours. During mid-day hours, Route M2, which operates every twenty to thirty minutes during this time period, reroutes to M1 sites to continue this service throughout the day. M1 offers no night or Saturday service.

Route M3, which services the Boylston and Lansdowne garages, runs every ten minutes in the morning and afternoon peak hours. It provides no mid-day, night or Saturday service.

Route M4, which services the Prentiss Street parking lot near Parker Street, runs every eight minutes in the morning and every ten to fifteen minutes in the afternoon peak hours. It provides no mid-day, night or Saturday service.

The M2 bus service, supported solely by funding from Harvard University, is free to all students, faculty, and staff of the Harvard Medical, Dental and Public Health schools. It is also available for sixty-five (65) cents per trip to members of the Harvard University community and for seventy-five (75) cents per trip to LMA Harvard affiliates (the major medical institutions). Route M2 is not open to the general public. M1, M3, and M4 bus fares are combined with the price of parking at these facilities, which is approximately fifty dollars ($50) to sixty dollars ($60) per month. No direct fee is charged to riders on these bus routes.

A major service issue of the Metrobus systems is its limited hours of operation from satellite parking facilities. With only emergency mid-day services available to lots on the M3 and M4 route, and thirty minute intervals between trips to lots on the M1 route, ridership is less attractive.

Similarly, lack of night, Saturday, and Sunday service on M1, M3, and M4 may prevent use of these services for employees on second and third shifts. Harvard's M2 bus service, by being closed to the public, also inhibits its optional use.

Other Bus Transportation

Other transportation services include Peter Pan Line, a private bus company, which offers hourly bus service between points along Huntington Avenue and Worcester with stops along Route 9, including the Shoppers World in Framingham. The cost from Framingham is two dollars and fifty cents ($2.50) each way. At the present time, less than 50 LMA employees utilize the service on a regular basis.

Transportation Management Organization

A final transportation service which merits notice is the MASCO Transportation Management Organization, called Commuterworks, the first TMO in the Commonwealth. MASCO has recently been awarded a $100,000 Federal grant to form this organization, with additional financial support coming from its member institutions. The TMO provides a variety of services which are aimed at reducing the number of LMA trips made in single passenger vehicles. Commuterworks makes use of CARAVAN, a state funded private non-profit corporation which provides ride-share and transportation brokerage services throughout the Commonwealth. Three vans are presently in operation in the LMA, and tt is estimated that 20 LMA employees use the Caravan services. Other TMO services include a ride-share service, which works to identify and link up commuters into carpools, and on-going information services on commuting alternatives.

Other Bus Transportation

Other transportation services include Peter Pan Line, a private bus company, which offers hourly bus service between points along Huntington Avenue and Worcester with stops along Route 9, including the Shoppers World in Framingham. The cost from Framingham is two dollars and fifty cents ($2.50) each way. At the present time, less than 50 LMA employees utilize the service on a regular basis.

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Parking

As the Longwood Medical Area continues its growth and development, and greater numbers of people use the area on a daily basis -- particularly hospital patients and visitors -- the demand for parking also increases. At present, there are 55 parking facilities -- surface lots and garages -- within the LMA boundaries, with a total capacity of 6,587 spaces. In addition, there are 890 curbside parking spaces along private and public roadways. (There are also 210 resident spaces located within the LMA.) There are an additional 4,177 spaces in 22 different facilities outside the LMA, but available to employees from LMA institutions. Nearly all of these spaces are located in the adjacent West Fens/Kenmore Square and Mission Hill neighborhoods. Combined, a total parking supply of 11,654 spaces exists for LMA employees, patients and visitors.

Of the total 7,477 parking spaces located within the Medical Area, 3,011, or forty percent (40%), are available for use by the general public. Of these two thousand two hundred forty-two (2,242) or seventy-five percent (75%) are located in surface lots or garages. The balance of 769 spaces, or twenty-five percent (25%) of all available general public parking, are curbside metered parking (344) and curbside unmetered spaces (425) which are restricted to certain hours.

BOSTON REDEVELOPMENT AUTHORITY
DISK: LOTUS 6
FILE: SORTLMA.WK1 (SORTED VERSION OF REV10YR.WK1)
TITLE: INSTITUTIONAL PROJECTS, 1990-2000+ -- SORTED BY CONSTRUCTION START IN LMA
21-Nov-91 02:41 PM

I. 1990

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Harvard Medical School East Quad Research Facility	185,000	185,000	0	473	391	$43,500	$217,500	$68.8	1990-II	1992-III	Under Construction
Harvard Medical School Underground Parking (W/EQRF)	175,000	0	175,000 500 spaces	49	2	$0	$0	$6.2	1990-II	1991-III	Under Construction
Harvard Medical School D-2 Building	44,000 (31m Rnvtn)	44,000	0	97	93	$0	$0	$13.8	1990-II	1991-II	Completed
Beth Israel Day Care	9,400	0	9,400 Day Care	8	24	$0	$0	$1.6	1990-II	1991-II	Completed
MASCO Mixed Use Development	339,600	0	280,359 Parking (750 Spaces) 59,241 Office	116	299	$0	$0	$28.0	1990-III	1992-II	Under Construction
1990 SUBTOTAL	753,000	229,000	524,000	742	809	$43,500	$217,500	$118.4			
CUMULATIVE TOTAL	753,000	229,000	524,000	742	809	$43,500	$217,500	$118.4			

II. 1991

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Beth Israel Rabb Building Expansion	5,791 (1376 rnvtn)	0	5,791 Clinical	10	11	$0	$0	$2.0	1991-II	1991-IV	Under Construction
New England Deaconess Palmer-Baker Bldg. Expansion	13,500	0	13,500 Admin	12	61	$0	$0	$3.0	1991-II	1992-I	Under Construction
Beth Israel NICU & Offices	17,000	0	11,333 Clinical 5,667 Office	26	48	$0	$0	$4.9	1991-II	1992-IV	Under Construction
Brigham and Women's Clinical Support Facility	268,000	0	268,000 clinical/ office	489	529	$268,000	$1,340,000	$48.5	1991-III	1993-IV	Under Construction
JMB/Macomber Olmsted Plaza, Phase I	300,000 (Renovation)	300,000	0	614	634	$200,000	$1,000,000	$100.0	1991-IV	1993-III	Contract Documents
Joslin Diabetes Center Research and Clinic Facility Expansion	84,230	35,060	39,320 Admin&Conf 9,850 Clinical	142	192	$0	$0	$28.0	1991-IV	1993-III	Contract Document
1991 SUBTOTAL	688,521	335,060	353,461	1,292	1,476	468,000	2,340,000	$186.4			
CUMULATIVE TOTAL	1,441,521	564,060	877,461	2,034	2,284	$511,500	$2,557,500	$304.8			

III. 1992

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
New England Deaconess Clinical Facility	330,736	0	330,736 Clinical	604	652	$230,000	$1,150,000	$140.0	1992-II	1994-II	Schematic Design
Mass. College of Pharmacy Science Building, Dining Facility, White Building Renovation	61,000	0	40,000 Academic 15,000 Acad.(Rnvtn) 6,000 Dining	44	178	$0	$0	$10.0	1992-IV	1994-IV	Planning Phase
Beth Israel/Mass. College of Art Development	836,000	0	500,000 Clin/Med 336,000 Parking (960 Spaces)	1,006	989	$400,000	$2,000,000	$137.8	1992-IV	1995-II	Schematic Design
Beth Israel Parking Garage (Emmanuel Site)	175,000 500 spaces	0	175,000 500 spaces	32	2	$0	$0	$6.7	1992-IV	1995-II	Schematic Design
1992 SUBTOTAL	1,402,736	0	1,402,736	1,686	1,821	630,000	3,150,000	294			
CUMULATIVE TOTAL	2,844,257	564,060	2,280,197	3,720	4,105	$1,141,500	$5,707,500	$599.3			

IV. 1993

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Brigham & Women's Tower Lobby Expansion	3,700	0	3,700	7	4	$0	$0	$0.9	1993-I	1994-IV	Schematic Design
Harvard School of Public Health Building II Expansion	100,000	100,000	0	256	211	$100,000	$500,000	$35.6	1993-I	1995-I	Schematic Design
Beth Israel Southeast Building	433,000 (241m new/ 192m rnvtn)	0	433,000 Clinical	721	854	$433,000	$2,165,000	$140.5	1993-II	1994-IV	Schematic Design
Brigham and Women's Medical Research Building Office	28,280 Renovation	0	28,280 Office	19	129	$28,280	$141,400	$4.0	1993-II	1995-II	Planning Phase
New England Deaconess Clinical Research Building	170,000	170,000	0	310	359	$170,000	$850,000	$68.7	1993-II	1995-IV	Planning Phase
1993 SUBTOTAL	734,980	270,000	464,980	1,313	1,557	731,280	3,656,400	$249.7			
CUMULATIVE TOTAL	3,579,237	834,060	2,745,177	5,033	5,662	$1,872,780	$9,363,900	$849.0			

V. 1994

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
JMB/Macomber Olmsted Plaza/ Phase I-B	300,000 Renovation	300,000	0	614	634	$300,000	$1,500,000	$100.0	1994	1996	Schematic Design
1994 SUBTOTAL	300,000	300,000	0	614	634	300,000	1,500,000	$100.0			
CUMULATIVE TOTAL	3,879,237	1,134,060	2,745,177	5,647	6,296	$2,172,780	$10,863,900	$949.0			

VI. 1995

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Mass. College of Pharmacy Science Building Addition and Parking	41,000	0	25,000 Academic 16,000 Parking	21	63	$0	$0	$3.7	1995-II	1996-II	Planning Phase
1995 SUBTOTAL	41,000	0	41,000	21	63	0	0	4			
CUMULATIVE TOTAL	3,920,237	1,134,060	2,786,177	5,668	6,359	$2,172,780	$10,863,900	$952.7			

VII. 1996

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Brigham & Women's Academic & Research Facility (Academic I)	178,500	66,000	112,500 Office	266	651	$178,500	$892,500	$40.0	1996	1998	Planning Phase
Harvard School of Public Health Building I Expansion	112,000	60,000	52,000 Academic	191	257	$112,000	$560,000	$29.2	1996	1998	Planning Phase
1996 SUBTOTAL	290,500	126,000	164,500	457	908	290,500	1,452,500	69			
CUMULATIVE TOTAL	4,210,737	1,260,060	2,950,677	6,125	7,267	$2,463,280	$12,316,400	$1,021.9			

VIII. 1997

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Mass. College of Pharmacy Dormitory and Related Facilities	71,000	0	55,000 300 beds 16,000 Dorm rltd.	52	2	$0	$0	$26.2	1997	1999	Planning Phase
1997 SUBTOTAL	71,000	0	71,000	52	2	0	0	26			
CUMULATIVE TOTAL	4,281,737	1,260,060	3,021,677	6,177	7,269	$2,463,280	$12,316,400	$1,048.1			

BOSTON REDEVELOPMENT AUTHORITY
DISK: LOTUS 6
FILE: SORTLMA.WK1 (SORTED VERSION OF REV10YR.WK1)
TITLE: INSTITUTIONAL PROJECTS, 1990-2000+ -- SORTED BY CONSTRUCTION START IN LMA
10-Oct-91 10:08 AM

I. 1990

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
● Harvard Medical School East Quad Research Facility	185,000	185,000	0	473	391	$43,500	$217,500	$68.8	1990-II	1992-III	Under Construction
Harvard Medical School Underground Parking (w/EQRF)	175,000	0	175,000 500 spaces	49	2	$0	$0	$6.2	1990-II	1991-III	Under Construction
Harvard Medical School D-2 Building	44,000 (31m Rnvtn)	44,000	0	97	93	$0	$0	$13.8	1990-II	1991-II	Completed
Beth Israel Day Care	9,400	0	9,400 Day Care	8	24	$0	$0	$1.6	1990-II	1991-II	Completed
MASCO Mixed Use Development	339,600	0	280,359 Parking (750 Spaces) 59,241 Office	116	299	$0	$0	$28.0	1990-III	1992-II	Under Construction
1990 SUBTOTAL	753,000	229,000	524,000	742	809	$43,500	$217,500	$118.4			
CUMULATIVE TOTAL	753,000	229,000	524,000	742	809	$43,500	$217,500	$118.4			

II. 1991

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Beth Israel Rabb Building Expansion	5,791 (1376 rnvtn)	0	5,791 Clinical	10	11	$0	$0	$2.0	1991-II	1991-IV	Under Construction
New England Deaconess Palmer-Baker Bldg. Expansion	13,500	0	13,500 Admin	12	61	$0	$0	$3.0	1991-II	1992-I	Under Construction
Beth Israel NICU & Offices	17,000	0	11,333 Clinical 5,667 Office	26	48	$0	$0	$4.9	1991-II	1992-IV	Under Construction
● Brigham and Women's Clinical Support Facility	268,000	0	268,000 clinical/ office	489	529	$268,000	$1,340,000	$48.5	1991-III	1993-IV	Under Construction
● JMB/Macomber Olmsted Plaza, Phase I	300,000 (Renovation)	300,000	0	614	634	$200,000	$1,000,000	$100.0	1991-IV	1993-III	Contract Documents
Joslin Diabetes Center Research and Clinic Facility Expansion	84,230	35,060	39,320 Admin&Conf 9,850 Clinical	142	192	$0	$0	$28.0	1991-IV	1993-III	Contract Document
1991 SUBTOTAL	688,521	335,060	353,461	1,292	1,476	468,000	2,340,000	$186.4			
CUMULATIVE TOTAL	1,441,521	564,060	877,461	2,034	2,284	$511,500	$2,557,500	$304.8			

III. 1992

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
● New England Deaconess Clinical Facility	330,736	0	330,736 Clinical	604	652	$230,000	$1,150,000	$124.5	1992-III	1994-II	Schematic Design
Mass. College of Pharmacy Science Building, Dining Facility, White Building Renovation	61,000	0	40,000 Academic 15,000 Acad.(Rnvtn) 6,000 Dining	44	178	$0	$0	$10.0	1992-IV	1994-IV	Planning Phase
Beth Israel/Mass. College of Art Development	734,000	0	500,000 Clin/Med 234,000 Parking (500 Spaces)	978	988	$400,000	$2,000,000	$177.0	1992-IV	1995-II	Schematic Design
Beth Israel Parking Garage (Emmanuel Site)	175,000 500 spaces	0	175,000 500 spaces	32	2	$0	$0	$6.7	1992-IV	1995-II	Schematic Design
1992 SUBTOTAL	1,300,736	0	1,300,736	1,658	1,819	630,000	3,150,000	318			
CUMULATIVE TOTAL	2,742,257	564,060	2,178,197	3,692	4,104	$1,141,500	$5,707,500	$623.0			

IV. 1993

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Brigham & Women's Tower Lobby Expansion	3,700	0	3,700	7	4	$0	$0	$0.9	1993-I	1994-IV	Schematic Design
Harvard School of Public Health Building II Expansion	100,000	100,000	0	256	211	$100,000	$500,000	$35.6	1993-I	1995-I	Schematic Design
Beth Israel Southeast Building	433,000 (241m new/ 192m rnvtn)	0	433,000 Clinical	721	854	$433,000	$2,165,000	$140.5	1993-II	1994-IV	Schematic Design
Brigham and Women's Medical Research Building Office	28,280 Renovation	0	28,280 Office	19	129	$28,280	$141,400	$4.0	1993-II	1995-II	Planning Phase
New England Deaconess Clinical Research Building	170,000	170,000	0	310	359	$170,000	$850,000	$68.7	1993-II	1995-IV	Planning Phase
1993 SUBTOTAL	734,980	270,000	464,980	1,313	1,557	731,280	3,656,400	$249.7			
CUMULATIVE TOTAL	3,477,237	834,060	2,643,177	5,005	5,661	$1,872,780	$9,363,900	$872.7			

V. 1994

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
JMB/Macomber Olmsted Plaza/ Phase I-B	300,000 Renovation	300,000	0	614	634	$300,000	$1,500,000	$100.0	1994	1996	Schematic Design
1994 SUBTOTAL	300,000	300,000	0	614	634	300,000	1,500,000	$100.0			
CUMULATIVE TOTAL	3,777,237	1,134,060	2,643,177	5,618	6,295	$2,172,780	$10,863,900	$972.7			

VI. 1995

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Mass. College of Pharmacy Science Building Addition and Parking	41,000	0	25,000 Academic 16,000 Parking	21	63	$0	$0	$3.7	1995-II	1996-II	Planning Phase
1995 SUBTOTAL	41,000	0	41,000	21	63	0	0	4			
CUMULATIVE TOTAL	3,818,237	1,134,060	2,684,177	5,639	6,358	$2,172,780	$10,863,900	$976.4			

VII. 1996

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Brigham & Women's Academic & Research Facility (Academic I)	178,500	66,000	112,500 Office	266	651	$178,500	$892,500	$40.0	1996	1998	Planning Phase
Harvard School of Public Health Building I Expansion	112,000	60,000	52,000 Academic	191	257	$112,000	$560,000	$29.2	1996	1998	Planning Phase
1996 SUBTOTAL	290,500	126,000	164,500	457	908	290,500	1,452,500	69			
CUMULATIVE TOTAL	4,108,737	1,260,060	2,848,677	6,096	7,266	$2,463,280	$12,316,400	$1,045.6			

VIII. 1997

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Mass. College of Pharmacy Dormitory and Related Facilities	71,000	0	55,000 300 beds 16,000 Dorm rltd.	52	2	$0	$0	$26.2	1997	1999	Planning Phase
1997 SUBTOTAL	71,000	0	71,000	52	2	0	0	26			
CUMULATIVE TOTAL	4,179,737	1,260,060	2,919,677	6,148	7,268	$2,463,280	$12,316,400	$1,071.8			

Longwood Medical Area

Existing Square Footage

(From Master Plans/Assessor's Records/Phone Conversations)
(8/28/91)

Institution	Campus Size	Existing Facilities
1. Harvard University	700,000 sf	1,792,870 sf (1,792,870 sf)

(This information taken from MASCO summary of institutional development. Master plan lists existing facilities in FAR SF at 1,362,300 sf. All other institutions except Brigham & Women are in GSF. Harvard has no existing parking garage facilities.)

2. Beth Israel	389,426 sf	1,310,878 sf (1,152,172 sf)

(This information taken directly from master plan. Master plan includes sf for parking garage (158,706 sf (486 spaces) on Brookline Ave). Master plan also includes sf for Research West, its new building. Leases of Emmanuel Science, 109 Brookline, and Queensbury St. garage parking not included in total. BI/Children's parking garage not included in total. BI's acquisition of the MCA site not included in total.)

3. New England Deaconess	376,000 sf	1,172,953 sf (801,603 sf)

(This information taken directly from master plan. Master plan lists existing facilities at 801,603 sf. Does not include sf for two garages; it only lists them and the number of spaces. By multiplying 350 sf by number of spaces (751 spaces for Pilgrim Rd. and 310 spaces for Francis St.), one gets an additional 371,350 sf of total gross floor area. This is now included in total. Master plan does not include what it calls off-site facilities it owns: 38,340 sf at 99 Brookline Ave for office functions; and 20,000 sf at 21-27 Burlington for research. This is not included in total.)

4. Brigham & Women's	432,625 sf	1,755,119 sf (1,671,119 sf)

(This information gained from phone conversation with Leo Byron at Brigham and Women's Hospital. Master Plan lists sf in Sf (FAR) and

therefore necessitated an adjustment to standardize report. Master plan lists main campus as 362,726 sf. The Boston Lying-In campus listed as 69,899 sf. Main campus gross floor area listed as 1,170,840 sf. BLI gross floor area listed as 163,442 sf. Total listed, therefore, is 1,334,282 sf. Master plans lists approximately 15 buildings which it leases partially or as a whole. The square footage totals 258,542 sf. This is not included in the total. Examples of these leases include parking at Servi-Center, 333 Longwood, 454 Brookline, Harvard Lot B building, Mission Park Garage, Jamiaca Plain and West Roxbury health centers etc. ASB II parking garage is not listed in the master plan. With 240 spaces at 350 sf per space, would add additional 84,000 sf to gross floor area. This is now included in total. Brigham & Women's sf numbers are presented in FAR SF. A GSF of 1755,119 is presented to standardize report.)

5. Children's Hospital	491,218 sf	1,728,471 sf (1,478,471 sf)

(1987 Master Plan for Children's is only for PDA. The main campus which comprises the PDA includes a campus area of 349,200 sf. The Master Plan further states that the gross floor area for this main campus is 1,157,671 sf. This does not include the Enders Research Expansion which is not yet completed. According to phone conversations with Children's facilities managers, Children's owns the following lots outside the main campus within the LMA: Gardner House; parking garage behind 319 Longwood; and the Galleria complex. The lot sizes are as follows: Gardner House and parking according to phone conversation (79,500 sf); the Galleria complex according to assessor's records (62,518 sf). According to phone conversations, the floor area of these lots are as follows: Gardner House (78,300 sf); parking garage (180,000 sf); the Inn, offices, retail and parking garage at the Galleria (190,000 sf); and the apartment tower at the Galleria (122,500 sf). Campus area outside the main campus totals 142,018 sf. Floor area of structures outside the main campus totals 570,800 sf. The garage behind 319 Longwood totals 434 spaces with a floor area of 180,000 sf. The garage within the Galleria totals 200 spaces. 350 sf times 200 spaces equals 70,000 sf. The BI/Children's parking deck is not included in total.)

6. Dana-Farber	116,643 sf	656,945 sf (571,545 sf)

(This information was gained through phone conversation with the institution's building supervisor. Building sf also included sf for 244 space garage. By mutiplying 350 sf, one gets 85,400 sf for garage.)

7. Joslin	56,840 sf	166,240 sf (166,240 sf)

(This information taken directly from master plan. Master plan includes sf for research addition of 15,000 sf, its new development. Joslin has no existing parking garage facilities.)

8. Judge Baker	37,349 sf	68,508 sf (68,508 sf)

(This information was gained from Assessor's records. Judge Baker has no existing parking garage facilities.)

9. Mass Coll of Art	292,800 sf	788,000 sf (788,000 sf)

(This information was gained through phone conversation with building and grounds supervisor. However, descrepencies were brought out without being solved. Supervisor says campus size 930,000 sf. Assessor's records, however, list BI/MCA campus size as 98,816 sf. Assessor's records lists MCA site bouned by Huntington and Palace Rd as 193,984 sf. These campus sf numbers are used as the totals listed above. Supervisor says existing campus sf is 823,000 sf. This includes 35,000 sf at 640 Huntington (the other side of Huntington), which is not included in the total. The breakout of facilities includes: 69,000 sf for BI/MCA site at Brookline/Longwood; and 719,000 sf for Huntington/Palace Rd campus. MCA has no existing parking garage facilities.

10. Mass Coll of Pharmacy	90,147 sf	90,630 sf (90,630 sf)

(This information taken directly from master plan. Master plan lists numerous rooms it leases. All are from institutions which would list this sf total. These leases are not included in total. Mass College of Pharmacy has no existing parking garage facilities.)

11. Boston English	130,542 sf	237,963 sf (197,363 sf)

(This information was gained from Assessor's records. Property cards describe building as 10 story and basement. Person says it includes sf of existing parking garage facility of 116 spaces. At 350 sf, parking facility totals 40,600 sf)

12. Boston Latin 260,579 sf 372,844 sf
(372,844 sf)

(This information was gained from Assessosr's records. Property cards describe it as two buildings and basements. Boston Latin has no existing parking garage facilities.)

13. Gardner Museum 55,162 sf 7,724 sf
(7,724 sf)

(This information was gained from Assessor's records. Records list three parcels for campus size: 45,862 sf; 5,000 sf; and 4,300 sf. Gardner Museum has no existing parking garage facilities.)

14. Temple Israel 127,300 sf 70,912 sf
(70,912 sf)

(This information was gained from Assessor's records. These list three parcels as being owned by Temple Israel: 221 Longwood (57,200 sf)(NOTE: THIS IS A BAD ADDRESS OFF ASSESSOR'S RECORD. 221 LONGWOOD IS LYING-IN. A CORRECT ADDRESS IS NEEDED); 405 Longwood (64,900 sf); and 260 The Riverway (5,200 sf). 221 Longwood is now under construction as the MASCO garage.)

15. Emmanuel College 731,786 sf 430,000 sf
(430,000 sf)

This information is taken from assessor's maps (campus) and 1987 MASCO transportation study (facilities). This includes Emmanual Science, which is leased by Beth Israel. This does not include the Beth Israel/Children's parking deck which is on Emmanuel's property. The land for this parking deck, however, is included in the campus total. Emmanuel's building supervisor is compiling exact figures for the institution and will provide them soon.

16. Simmons College 566,184 sf 671,496 sf
(671,496 sf)

(This information was gained through phone conversation with building and grounds supervisor. The Fenway campus land area is 318,728.5 sf; the Brookline residential campus land area is 247,456 sf. The sf of the buildings on the Fenway campus is 363,816 sf; the sf of the buildings on the Brookline residential campus is 307,680 sf. Simmons has no existing parking garage facilities.)

17. Wheelock College 153,650 sf 140,000 sf
(122,500 sf)

(This information gained from assessor's maps (campus size) and from 1987 MASCO transportation study (facilities). Building supervisor says he does not have this information for Wheelock. This data, therfore, is not exact. Wheelock has an existing parking garage facility of 50 spaces on Pilgrim Rd.)

18. Winsor School 323,723 sf 71,172 sf
(71,172 sf)

(This information was gained through telephone contact with building and grounds supervisor. Winsor has no existing parking garage facilities.)

19. MATEP 74,960 sf 276,447 sf
(276,447 sf)

(This information was gained from Assessor's records. It is listed as its own exempt institution. MATEP has no existing parking garage facilities.)

20. Other

319 Longwood 8,685 sf 29,489 sf
(29,489 sf)

(This information gained from Assessor's records. This parcel does not include sf of Children's parking garage facility behind building. It is included in Children's sf total.

333 Longwood 48,891 sf 236,182 sf
(96,466 sf)

(This information gained from Assessor's records. This site includes garage parking of 495 spaces. 139,716 sf for garage according to assessor's records.)

352 Longwood 5,231 sf 10,532 sf
(10,532 sf)

(This information gained from Assessor's records)

368-372 Longwood	27,074 sf	79,676 sf (79,676 sf)
(This information gained from Assessor's records)		
158 Longwood	1,852 sf	4,463 sf (4,463 sf)
(This information gained from Assessor's records)		
Service Center Garage	55,577 sf	227,500 sf (0 sf)
(This information gained from Assessor's records. 650 spaces times 350 sf equals building size.)		
Overholt Bldg	11,675 sf	8,564 sf (8,564 sf)
(This information gained from Assessor's records.)		
11 & 14 Tetlow Bldgs	10,690 sf	45,168 sf (45,168 sf)
(This information gained from Assessor's records)		
100 Riverway	8,095	25,000 sf (25,000 sf)
(Land sf information gained from Assessor's records. Building sf information is an estimation)		
114-122 Riverway	29,574	75,000 sf (75,000 sf)
(Land sf information gained from Assessor's records. Building sf information is an estimation)		

TOTALS	Land Area	Existing Facilities
	5,614,278 sf	12,550,746 sf (11,175,974 sf)

Land Ownership
Within Longwood Medical Area

Emmanuel College	730,000 SF
Harvard University-- Longwood Campus*	00,000 SF
Simmons College	565,000 SF
Children's Hospital	490,000 SF
Brigham & Women's Hospital	430,000 SF
Beth Israel Hospital	390,000 SF
New England Deaconess Hospital	375,000 SF
Winsor School	325,000 SF
Massachusetts College of Art	290,000 SF
Boston Latin High School	260,000 SF
Wheelock College	150,000 SF
Boston English High School*	130,000 SF
Temple Israel	125,000 SF
Dana-Farber Cancer Institute	115,000 SF
Massachusetts College of Pharmacy And Allied Health Services	90,000 SF
Joslin Diabetes Center	55,000 SF
Isabella Stuart Gardner Museum	55,000 SF
Judge Baker Children's Center	40,000 SF
Other (residential, commercial, office)	150,000 SF

* Harvard land ownership does not include Medical Area Total Energy Plant (MATEP), a Harvard holding company. Power plant occupies 75,000 SF of land.

* Boston English no longer open.

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Apartments and Condominiums within the Longwood Medical Area

Institutional	# of Units
Galleria (Childrens)	154
306 The Riverway (Deaconess)	38
TOTAL	192
Private	
368-372 Longwood	84
11 & 14 Tetlow	62
100-122 The Riverway	134
TOTAL	280

Dormitory Beds within Longwood Medical Area

Institution	
Harvard School of Public Health	70
Harvard Medical School	
Simmons College	1,100
Emmanuel College	400
Wheelock College	500
Mass College of Pharmacy	220

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Hospital Employment

Beth Israel	5,000
Brigham & Women's	7,000
Children's	5,000
New England Deaconess	3,000
Dana-Farber	1,500
Joslin	350

Student Enrollment

Simmons College	2,900
Boston Latin High School	2,300
Mass. College of Art	1,200
Emmanuel College	1,000
Mass. College of Pharmacy	1,000
Wheelock College	900
Harvard Medical School	700
Harvard School of Public Health	500
Harvard School of Dental Medicine	
Winsor School	375

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Existing Development

More than 12.5 million gross square feet (GSF) of developed space exist within the LMA. This development includes more than 11.1 million GSF of building space and just under 1.4 million GSF of structured parking for more than 4,000 cars. This represents the equivalent of six John Hancock Towers within a one-quarter square mile of land. Many major cities in the U.S. do not have a downtown of this size, and in many respects, this area is similar to parts of downtown Boston. The financial district, for example, is comprised of approximately twenty-five million GSF of "Class A" office space. While significantly larger, it highlights the density of LMA in relation to other parts of the city.

Most development within the LMA is concentrated in the southern half of the area where the medical institutions are located. The five hospitals, in addition to the Joslin Diabetes Center, account for approximately 6.8 million square feet of space, while the three Harvard schools add approximately 1.8 million square feet. An additional 850,000 square feet of space is located in Judge Baker Children's Center, the two office complexes, the Medical Area Total Energy Plant (MATEP), and the Servicenter Garage, which all provide direct support to these institutions. In total, medical institutions and medical-related property account for more than 9.4 million square feet of space. All but Beth Israel Hospital and Judge Baker Children's Center either abut Longwood Avenue or are located to its south. The non-Harvard academic and cultural institutions, in contrast, account for just under three million square feet of space and either about Longwood Avenue or are to its north.

Building Square Footage
Within Longwood Medical Area

Harvard University-- Longwood Campus*	1,800,000 GSF
Children's Hospital	1,800,000 GSF
Brigham & Women's Hospital*	1,400,000 SF (FAR)
Beth Israel Hospital	1,300,000 GSF
New England Deaconess Hospital	1,200,000 GSF
Massachusetts College of Art	800,000 GSF
Simmons College	675,000 GSF
Dana-Farber Cancer Institute	650,000 GSF
Emmanuel College	450,000 GSF
Boston Latin High School	350,000 GSF
Boston English*	240,000 GSF
Joslin Diabetes Center	170,000 GSF
Wheelock College	140,000 GSF
Massachusetts College of Pharmacy And Allied Health Services	90,000 GSF
Winsor School	70,000 GSF
Temple Israel	70,000 GSF
Judge Baker Children's Center	70,000 GSF
Isabella Stuart Gardner Museum	25,000 GSF
Other (residential, commercial, office)	650,000 GSF

* Harvard total does not include MATEP plant, a Harvard holding company. Power plant totals 275,000 GSF.

* Brigham & Women's Hospital total is listed in SF(FAR). GSF total would be approximately 1,800,000 GSF.

* Boston English no longer open.

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Within the medical institutions, building occupancy is primarily devoted to clinical care and research activities. Of the 6.8 million square feet located within the seven medical institutions, 3.4 million, or one-half of all medical space, supports the clinical care functions of these institutions, while research accounts for 1.1 million square feet, or sixteen percent of all medical space. Office functions account for 800,000 square feet, or twelve percent of all space, and commercial and residential tenants occupy approximately 500,000 square feet. The balance (approximately 1,000,000 GSF), accounting for fifteen percent of all medical space, is used for parking garage facilities for more than 3,000 cars.

Open Space

Due to the high concentration of development, public open space is extremely limited, particularly in the area south of Longwood Avenue. The Riverway and Back Bay Fens sections of the Emerald Necklace, one of Boston's largest parklands, however, abut two sides of the LMA. These areas provide open space opportunities for those institutions which abut them. Evans Way Park, a 75,000 square foot park, is located adjacent to the Mass. College of Art and Simmons College campuses.

Within the area south of Longwood Avenue, however, open space is sparse. While The Riverway section of the Emerald Necklace borders the New England Deaconess Hospital, the only public open spaces within the immediate area are Joslin Park, Children's Park, and the semi-public Harvard Quadrangle. The land area of these three parks totals less than 75,000 square feet.

B. PLANNED DEVELOPMENT IN THE 1990s

1. Proposed Development Between 1990 and 2000

Current master plans of LMA institutions include proposals for the construction of more than 3.9 million square feet of space within the next ten years. Approximately 450,000 of this total includes the renovation of existing buildings. Project proposals also call for the demolition and removal of approximately 350,000 square feet as part of these development plans, for a total net additional development, of 3.1 million square feet. These proposals represent an increase from 12.5 million to 15.6 million square feet of space, or a twenty-five percent increase in developed space within the next ten years. Most of this projected construction will be completed by the end of 1995.

Building construction is almost entirely medical-related, and is concentrated in research and clinical care facilities. Of the 3.9 million square feet of proposed new construction, medical research accounts for just under one million square feet, while clinical care facilities account for more than 1.3 million square feet. Medical-related office space accounts for almost 460,000 square feet and academic space just under 300,000 square feet. The remaining project proposals include 850,000 square feet for parking garage facilities and 57,000 square feet for child care facilities and retail space.

The seven major medical institutions will grow from an existing size of 6.8 million to 8.7 million square feet, and the Harvard University campus will grow from 1.8 million 2.3 million square feet. Other private medical related property will increase from

850,000 to just under 1.2 million square feet. Total medical-related space will reach 12.2 million square feet, an increase of 2.8 million over the existing level of 9.4 million square feet. The Mass. College of Pharmacy is the only other institution presently contemplating development, which is defined in this study as educational space. It proposes a net increase of a space of approximately 160,000 square feet. Total cultural and educational space, therefore, will increase to 3 million square feet. With the exception of development that will occur on Beth Israel's main campus, all construction within the LMA will take place either along Longwood Avenue, or to its south.

This growth will provide tremendous benefits to the city and region. The total development cost is valued at $800 million. Approximately 5,500 construction jobs are expected to be generated from these projects, with most hirings occurring within the next five years. Permanent jobs resulting from this growth are estimated to total 7,000, with the majority generating higher than average wages. And the city is expected to receive approximately $10.1 million in housing linkage funds and $2.0 million in job training linkage funds as well. This growth will help this area maintain its national leadership role in the health care field, provide direct economic benefits to the residents and city of Boston, and assist in efforts to attract and retain private, for-profit industry around this complex.

This growth, however, will also create negative impacts within the LMA and surrounding neighborhoods. Additional development further reduces the area's

physical and visual open spaces. New development could possibly exacerbate traffic, parking, and environmental conditions. Transportation networks are at or near failing levels at many intersections. Parking garage facilities now occupy just under 1.4 million square feet for 4,000 spaces. The construction of 850,000 square feet of new parking will add 2,300 spaces. While parking is necessary to support this complex, it could add to existing traffic problems and adversely contribute to air and noise quality levels if corresponding mitigation measures are not undertaken.

Adjacent neighborhoods are bearing the burden of these development pressures as well. Traffic flows increase on neighborhood streets as arterials become congested. In addition, institutional employees and visitors park on neighborhood streets, taking up important residential parking spaces. All have the effect of changing the character of these neighborhoods to the detriment of all who live there.

These are area-wide issues that are critical to the future of the LMA and surrounding communities. They require a collective response. With a development management plan which attempts to facilitate growth while protecting the long-term character of the LMA and surrounding communities, the impacts of growth can be addressed and mitigated.

2. Medical Research Space

Approximately 1.1 million square feet of medical research space presently exists within the LMA. This represents more than forty percent of the 2.6 million square feet of research space in Boston as a whole.

The vast majority (1 million square feet) of medical research space in the LMA is located within the five hospitals and Joslin Diabetes Center. The Harvard Medical and Dental Schools and the School of Public Health account for just under 100,000 square feet of research space.

An estimated 1.2 million square feet of additional research space is projected to be built between 1991 and the year 2000, more than a 100 percent increase. Approximately 1 million feet of this future development involves specific proposals for research facilities (see appendix). The remaining 200,000 has been identified through surveys of these institutions, but specific proposals have yet to be developed. Two-thirds of all future research space, totalling approximately 800,000 square feet, is expected to be built by the hospitals and Joslin Diabetes Center, while the Harvard professional schools have developed proposals for just under 400,000 square feet of space. Overall, if all future demand for research space is met, it will account for one-fourth of all proposed development within the LMA over the next ten years.

Many of the proposed medical research projects are at or exceed 100,000 square feet, although a number of planned projects include much smaller space requirements. The major proposed medical research projects include:

Facility	Square Feet
CH Enders Research	142,800
BW LMRC	99,659
HMS EQRF	185,000
HSPH Building II	100,000
NEDH Research Facility	170,000

Approximately 1.4 million square feet of medical research space is planned to be built in Olmsted Plaza, located in the former Sears Building next to the LMA, over the next ten years. This development is designed to partially accommodate this growing demand for research space within the LMA as well as to attract additional research opportunities. It will have both private and institutional medical research facilities to accommodate both small and large tenants.

The tremendous growth in medical research stems in large part from continued federal investment in medical research. The National Institute of Health (NIH), the primary sponsor of medical research, has increased its budget at an average annualized rate of 11 percent from 1970 to 1987. For Harvard University and its affiliated institutions, annual increases have averaged approximately 11.5 percent during this same time period. Projections are that these institutions will continue to keep pace with federal allocations throughout the 1990s.

LMA institutions are major recipients of research grants. Four of the top seven recipients of NIH grants to independent hospitals were LMA institutions. Only five states, including Massachusetts, received more NIH funding than the LMA as a whole. The five hospitals and Joslin received more than $150 million from NIH in 1989 while Harvard University received approximately $100 million. Total NIH support therefore exceeded $250 million. The total budget of these institutions for medical research was approximately $400 million in 1989. The estimated budget for medical research by LMA institutions could reach $600 million in constant dollars by the year 2000.

The number of permanent jobs created by the expected growth in research is estimated to be between 1,500 and 2,500. The average square footage per full-time research employee is now estimated at 325 square feet. Based on surveys from the hospitals and professional schools, the "optimal" square footage per employee is 473 square feet. If institutions attempt to alleviate overcrowding and meet conservative projections of future research support, employment estimates will be closer to 1,500 new jobs.

These estimates would bring total employment in medical research by LMA institutions to more than 6,000 employees, or a 60% increase over existing research employment levels. The educational skills needed by new employees is estimated to be similar to existing employment breakdowns. The total payroll for medical research could reach between $190 million in constant dollars by the year 2000.

3. Clinical Care Space

Approximately 3.4 million square feet of clinical space exists within the LMA. This represents 50 percent of all hospital and medical center space. This space supports 2,080 licensed beds.

An estimated 1.3 million square feet of clinical space is proposed to be built between 1990 and the year 2000. Only a small portion of this space, however, will result in an increase in bed capacity. The major thrust of this development is the modernization of existing bed facilities and the renovation and expansion of outpatient facilities. Because inpatient admissions have increased only slightly over the last few years and the average length of stay has continued to drop, new bed expansion has not been necessary. Treatment, though, is being directed more and more to outpatient facilities, necessitating such expansion within most major hospitals.

Proposed clinical space development will significantly affect individual campus designs and operations. Of the projects presently proposed, four are in excess of 100,000 square feet, including three projects over 300,000 square feet. The major proposed projects include:

Facility		Square Feet
1.	NEDH Clinical Facility	323,000
2.	BI Inpatient Facility	307,000
3.	BI MCA Site	373,000
4.	BW Clinical Support Facility	213,000
5.	NEDH Ambulatory Facility	85,000

Patient care in the LMA accounted for approximately $900 million in revenues in 1989. This represents the majority of all health care-related revenues. There are approximately 14,000 employees in the clinical care functions of these hospitals and medical centers, whose average salary is $24,000, ranging from $67,000 for doctors to $15,000 for janitorial personnel. The total payroll is approximately $340 million.

The number of jobs created by growth in patient care is estimated to be between 2,000 and 2,500 additional jobs. This represents a fifteen percent increase in patient care employment over the next ten years. With this growth, the total payroll for patient care could potentially reach between $385 and $400 million in constant dollars by the year 2000.

4. Medical Office and Retail Space

Approximately 800,000 square feet of office space presently exists within the LMA's health care facilities. Approximately 460,000 square feet of new office space is projected to be built between 1990 and the year 2000. All such construction, with the exception of MASCO's mixed-use project, which includes 70,000 square feet of office space, will occur within the hospitals and Joslin.

Most of these proposed projects are much smaller in scale, although three projects proposed will come close to or exceed 100,000 square feet. The major projects include:

Facility		Square Feet
1.	MASCO Mixed-Use	70,000
2.	BW Clinical Support Facility	90,000
3.	BI Mass. College of Art	100,000
4.	BW Academic I	

Approximately 4,000 people are employed in office functions for these medical institutions, with an average salary of $22,000 and a total payroll of approximately $90 million. Projected increases in administrative and office personnel are estimated to total between 1,000 to 2,000 additional employees after the completion of these projects.

An additional 57,000 square feet of retail and child care space is also proposed to be built. This includes 27,000 square feet of retail space in the historic Mass. College of Art building as part of Beth Israel's development of this parcel. In addition, New England Deaconess will provide 8,000 square feet of retail space within its planned Clinical Facility and MASCO will provide 5,000 square feet of retail space within its mixed-use building. MASCO and Beth Israel are presently constructing child care sites each totalling between 8,000 and 9,000 square feet. These projects are estimated to generate approximately 150 additional jobs.

5. Academic Space

An additional 300,000 square feet of academic space is projected to be built over the next decade by Harvard University and the Mass. College of Pharmacy. 100,000 square feet of this construction includes the renovation of existing buildings. The balance includes the construction of additional dormitory, classroom, office, and dining facilities. Approximately 350 additional jobs are expected to be generated from these projects.

These projects include:

Facility		Square Feet
1.	HMS Vanderbilt Dormitory	84,000
2.	Mass. College of Pharmacy Science/ White	61,000
3.	Mass. College of Pharmacy Science Addition	373,000
4.	HSPH Building I	52,000
5.	Mass. College of Pharmacy Dormitory	71,000

6. Parking

Approximately 1.4 million square feet of structured parking facilities with 4,400 spaces exist in the LMA. An additional 800,000 square feet is projected to be built between 1990 and 2000 to provide an additional 2,300 spaces. Two projects, Harvard's underground garage and MASCO's mixed-use project, are presently under construction. These total 430,000 square feet with 1,250 spaces. Beth Israel's Mass. College of Art development calls for the construction of a 500-space garage, and its on-campus development calls for an additional 500 space facility. The Mass. College of Pharmacy development calls for 50 additional spaces in garage facilities as part of its mixed-use development. These future projects will add an additional 425,000 square feet of parking facility space in the area. All such projects with the exception of the Mass. College of Pharmacy's garage facility are designed to support medical-related growth within the LMA.

Future proposed projects and their total square footage are below:

Facility		Square Feet
2.	BI Mass. College of Art (500)	234,000
3.	BI Parking Garage (500)	175,000
4.	Mass. College of Pharmacy Parking Garage (50)	16,000

PARKING INVENTORY

Facility Name	#	Public	Private	Total
(Surface Lots - Onsite)				
Beth Israel				
320-330 Brookline Avenue	1A	20	0	20
336 Brookline Avenue	1B	0	116	116
340-350 Brookline Avenue	1C	0	29	29
Brigham & Women's				
721 Huntington Avenue	2A	22	14	36
56 Shattuck Street	2B	0	19	19
26 Binney Street	2C	49	0	49
221 Longwood Avenue	17	0	30	30
225 Longwood Avenue	12F	0	18	18
Children's Hospital				
Blackfan	3	0	32	32
Deaconess Road	26	10	20	30
283 Longwood Avenue	28	50	0	50
Dana-Farber Cancer Institute				
65 Deaconess Road	4	0	32	32
Joslin Diabetes Center				
356 Longwood Avenue	5	0	20	20
Deaconess Hospital				
18 Autumn Road	6B	0	23	23
454 Brookline Avenue	6C	0	86	86
Winsor School				
214 The Riverway	8A	0	24	24
118 Pilgrim Road	8B	0	60	60
Wheelock College				
25 Pilgrim Road	9	0	60	60
Boston Latin School				
78 Avenue Louis Pasteur	10A	0	53	53
78 Avenue Louis Pasteur	10B	0	60	60
Boston English School				
77 Avenue Louis Pasteur	11	0	25	25
Harvard Medical School				
29 Shattuck Street	12A	0	52	52
286 Longwood Avenue	12B	0	11	11
659 Huntington Avenue	12C	0	30	30
180 Longwood Avenue	12D	0	14	14
188 Longwood Avenue	12E	0	21	21
230 Longwood Avenue	12G	0	37	37
107 Louis Pasteur	12H	0	65	65
695 Huntington Avenue	12I	0	18	18
Blackfan	55	0	223	223
Mass College of Pharmacy				
179 Longwood Avenue	14A	0	117	117
179 Longwood Avenue	14B	0	23	23
Emmanuel College	15A-E	0	228	228
Simmons College				
54 Pilgrim Road	16A	0	9	9
82 Pilgrim Road	16B	0	15	15
42 Avenue Louis Pasteur	16C	0	375	375
Mass College of Art				
179 Palace Road	25	0	18	18
173 Palace Road	22	0	25	25

335 Longwood Avenue	13	58	80	138
Temple Israel				
3 Plymouth Street	7	0	0	0
42 Lots Subtotal		209	2,082	2,291

(Garages - Onsite)

Beth Israel				
336 Brookline Avenue	31	364	119	483
Emmanuel Deck	15C	0	200	200
Brigham & Women's				
ASBII		240	0	240
Children's Hospital				
Blackfan	33	429	0	429
333 Longwood Avenue	37	195	300	495
Galleria	38	60	50	110
Emmanuel Deck	15C	0	200	200
Dana-Farber Cancer Institute				
44 Binney Street	34	144	100	244
Deaconess Hospital				
110 Francis Street	35	160	150	310
378 Longwood Avenue	39	116	645	761
Boston English High School				
77 Avenue Louis Pasteur	40	0	116	116
Wheelock College	30	0	40	40
Overholt Thoracic Clinic				
35 Francis Street	41	0	18	18
ServiCenter Garage				
488 Brookline Avenue	36	325	325	650
13 Facilities Subtotal		2,033	2,263	4,296
Total Onsite		2,242	4,345	6,587

(Surface Lots - Offsite)				
Mass College of Art				
Huntington	49	0	295	295
130 Peterborough	23	0	80	80
Kenmore/Red Sox		0	277	277
Salvation Army		0	20	20
Fenmore Realty		0	90	90
Mattes Management		0	42	42
Mass. Tire Corp.		0	115	115
Laz Parking Lot		0	140	140
Wentworth		0	380	380
Mass Mental Health				
74 Fenwood Road	27A	0	76	76
Viking Street	27B	0	44	44
Wentworth Institute (CH)		0	245	245
Children's Hospital				
819 Beacon Street		0	220	220
Longwood Towers		0	50	50
Sears				
31 Jersey Street (NEDH)		0	80	80
Calumet Street (BWH)	60	0	55	55
Total Surface		0	2,209	2,209
(Garages - Offsite)				
59-75 Queensberry St. (BI)	53	0	81	81
91-101 Queensberry St. (BI)		0	40	40
Mission Park Management				
22 Vining Street (BWH)		0	1,362	1,362
Brigham Dr. Lot (BWH)		0	55	55
One Brookline Place		0	150	150
Lansdowne Garage		0	280	280
Total Garage		0	1,968	1,968
Total Offsite		0	4,177	4,177
Total Onsite and Offsite		2,242	8,522	10,764

KENMORE SQUARE Workbook

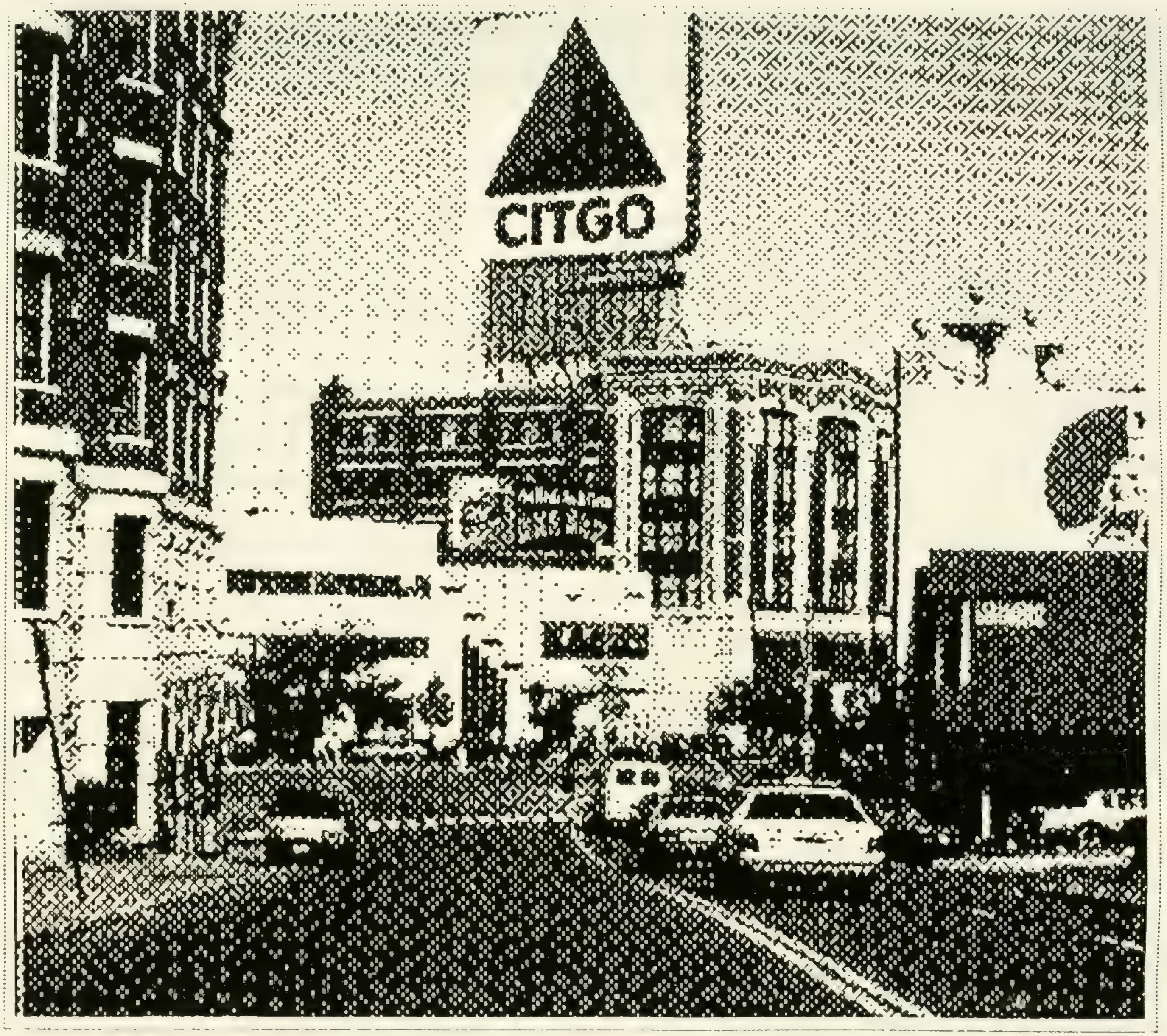
Shaping the Future of the Square

July 26, 1989

Melvin F. Levine & Associates, Inc.
city planning and development

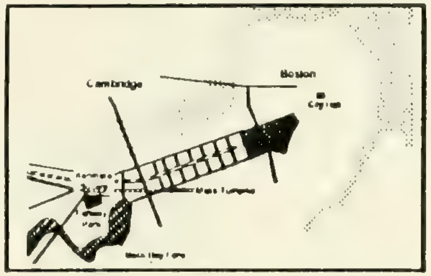
David Dixon & Associates
urban design

Barry M. Abramson & Associates
market analysis



Contents and History

Kenmore Square has played a number of roles over the past century.



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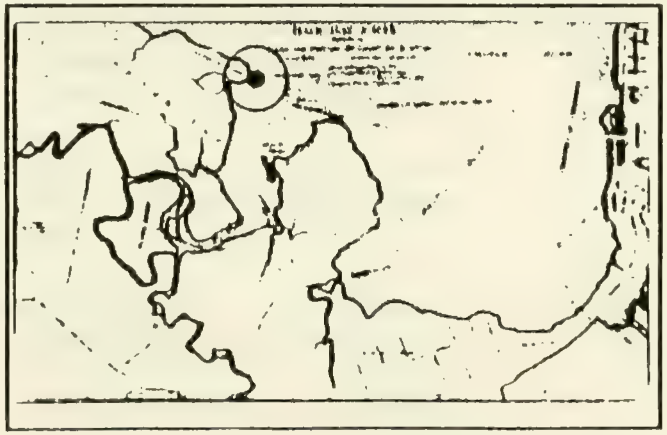


map showing Kenmore Square area (shown black) in 1814, before land fill

History:

Kenmore Square is located on the original peninsula of Sewalls Point, which projected into the Charles River basin from Brookline. It became the western gateway to the historic Back Bay residential district created by the great landfill of the 19th century. It always has been a transportation crossroad, traversed successively: by the Boston and Worchester Railroad in the 1830's; by Beacon Street in 1860; by Brookline Avenue in 1861; by Commonwealth Avenue in 1868; by horsecar rail lines in the 1880's, through electric streetcars, to the subway; and by the Massachusetts Turnpike in the 1960's.

Before the filling of the Back Bay, the area was marked by hotels and a rail station. Rowhouses were built in the 1890's, and Kenmore Square emerged as a fashionable extension of the Back Bay: a district of grand hotels and residences at the end of Olmsted's Commonwealth Mall. Fenway Park and the baseball crowds became increasingly lively neighbors after 1912. The Square evolved into an important medical center as residences were converted to doctors' offices. Automobile showrooms and services appeared for a brief period and then disappeared. Nightclubs began to appear at significant locations in the 1960's. The stabilizing influences of the Longwood/Fenway medical/educational district and the Charles River campus of Boston University are now in the ascendency. **This Urban Design Workbook suggests guidelines for development in Kenmore Square as the Square continues to evolve.**

Part I: Kenmore Square Today

1. How the Square Works

The Square is a lively meeting ground for neighborhood residents, students, and employees.

Kenmore Square Planning District

The Kenmore Square Planning District defined for this workbook is an area of approximately 38 acres bounded by Bay State Road to the north, Charlesgate West to the east, the Massachusetts Turnpike to the south, and Blandford and Sherborn Streets to the west. (See map on p. 5.)

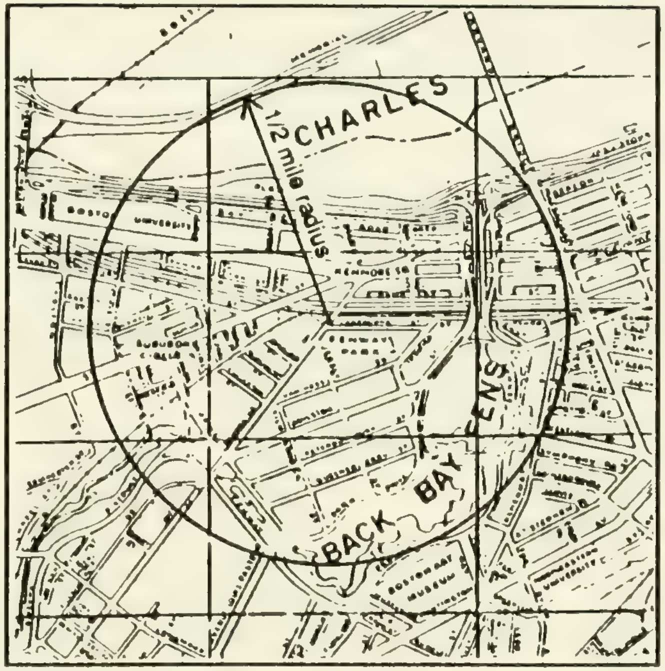
Inventory of Uses

There are approximately 70 properties in the Kenmore Square Planning District. They provide the following kinds of spaces for the uses shown in parentheses:

Retail Space (restaurants, stores, and other consumer services)	251,000 s.f.
Office and Loft Space (educational, health, religious, social, professional, and miscellaneous services)	412,000 s.f.
Hotel Space (hotel and other lodging places, totalling 339 rooms)	181,000 s.f.
Residential Space (apartments, houses, and dormitories)	820,000 s.f.
Total Occupied Space	1,661,000 s.f.

By comparison, for Retail Uses only, the properties immediately surrounding Harvard Square in Cambridge contain approximately 150,000 SF of Retail Uses. In addition, the adjacent blocks contain 200,000 SF of Retail Uses. The properties immediately surrounding Copley Square in the Back Bay contain approximately 100,000 SF of Retail Uses. In addition, Copley Place contains approximately 350,000 SF of Retail Uses.

Kenmore Square Trade Area



The Market

The retail uses in Kenmore Square derive a majority of their market support from residents, students, and employees living or working within a one-half mile radius trade area around the Square. Most of these customers walk in to the restaurants and stores from nearby residences and places of work.

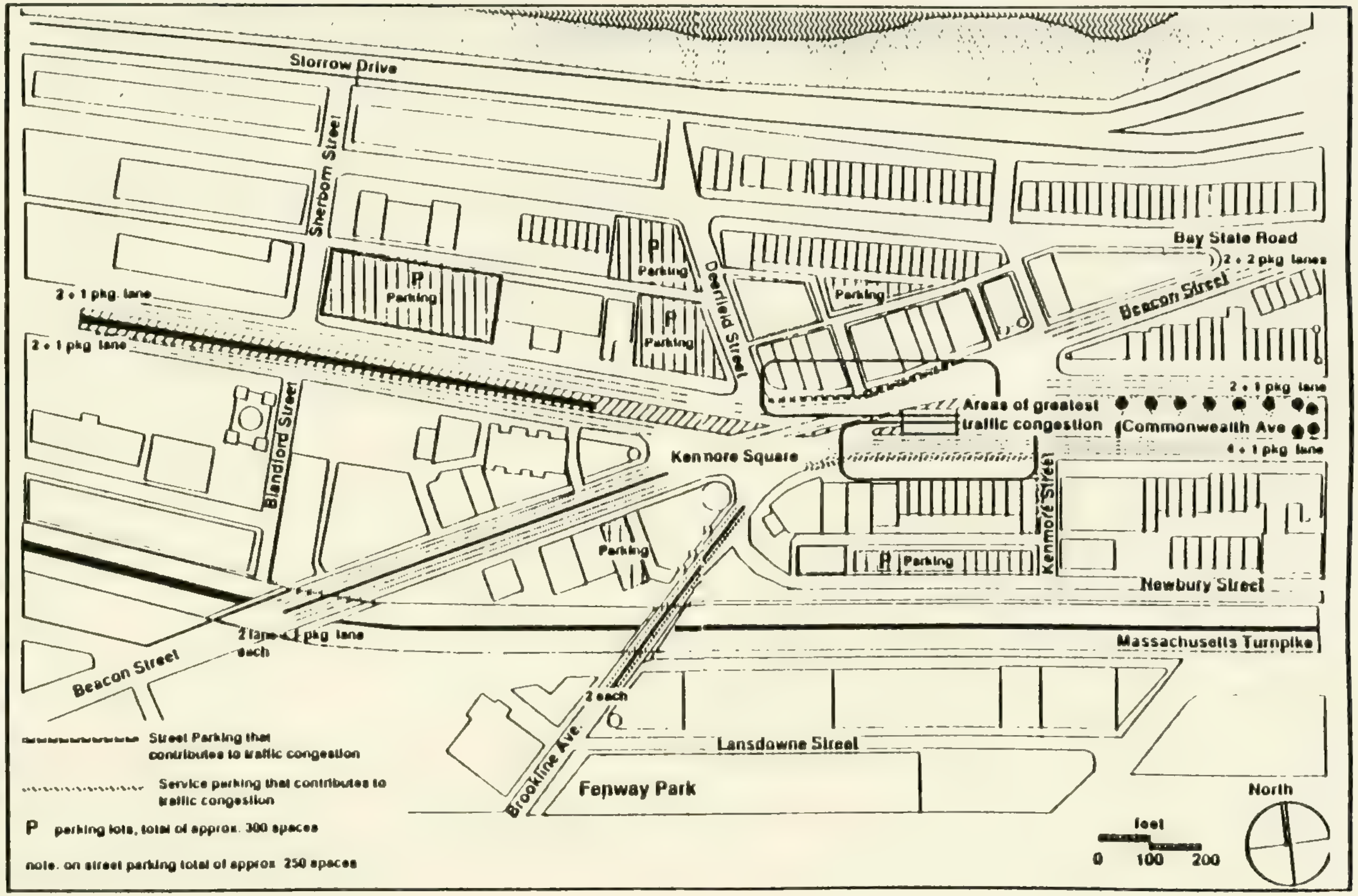
There are 17,900 residents in the trade area. This includes approximately 6,000 students in group quarters. There are 29,800 employees in businesses and institutions in the trade area. This includes 20,800 white collar workers who provide substantial support for the restaurants and stores in Kenmore Square.

The businesses in Kenmore Square also derive a modest amount of support from the 2.0 million people a year who attend baseball games and events at Fenway Park.

Traffic and Parking

- Through-traffic is the chief source of traffic congestion in the Square.
- Illegal parking and double parking contribute to traffic congestion.
- Establishments in the Square rely on transit and pedestrian access.
- Parking is limited and fully utilized – 250 on-street spaces, 300 off-street spaces. New development may require additional parking.

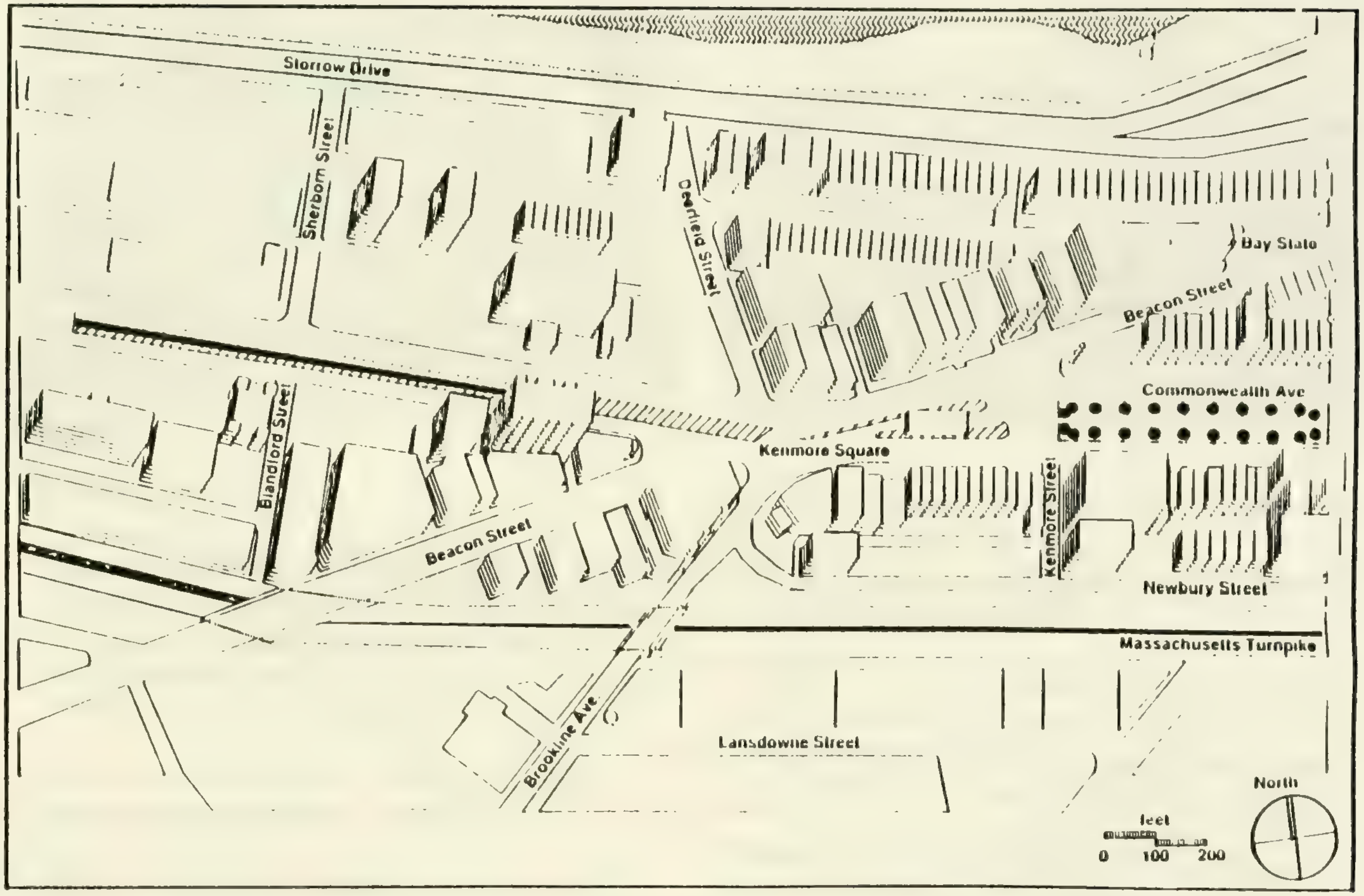
Through-traffic and illegal parking congest the Square's streets.



Varied building heights and massings characterize the Square; parking lots reduce a sense of spatial enclosure at its western end.

Existing Building Streetwall Heights and Massings

- Existing building streetwalls show two predominant heights:
  - approximately 85' on north and west sides;
  - approximately 60' on south side.
- The square lacks a sense of spatial enclosure because of parking lots at its northwest corner.
- Narrow parcels, frequent side streets, and the vertical expression of bays and piers give a comfortable scale even to existing tall buildings



2. Comparisons with Other Squares

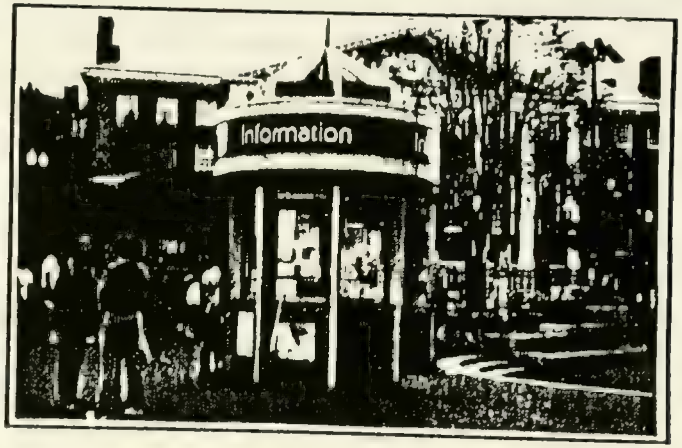
Copley and Harvard Squares offer examples of neighborhood squares animated by surrounding streets and buildings.

Copley Square

- The reconstruction of the central public space, to make it directly accesible to streets, will increase the Square's use and improve its symbolic public character. Generous sidewalks (including landscaping and seating) and active retail uses will encourage pedestrian activity.

- Consistent streetwalls and cornice heights of surrounding buildings provide spatial enclosure for the Square.

- The blank street-level walls of the Hancock tower and Copley Place do not contribute activity to the Square.



Harvard Square

- The Square shows a successful and diverse mix of land uses, active by day and by night.

- The Square consists of a series of well-integrated public spaces, enlivened by active storefronts and the "Out-of-Town News", and framed by well-scaled building walls. The scale is enhanced by frequent cross streets

- Vehicular traffic has been limited to encourage successful pedestrian spaces, and improve traffic circulation.

3. An Urban Design Framework for Kenmore Square

The Square's resources, and lessons from other squares, suggest an urban design framework which joins public and private improvements.

The following urban design framework builds on the resources available in the Square, as well as on the lessons of other urban squares in Boston. Neither improvements to the public environment, nor new development within the private environment, should be seen in isolation. In general, the elements of the public and the private environment need to be seen together as integral parts of an urban design framework. This framework offers the chance to solve some current problems in the Square, and to help it live up to its potential as a vital public place.

Elements of Public Environment:

- The creation of well located, active, public space as a new focus for the Square;
- Improvements to public streets to allow enhanced public space and improve pedestrian crossings;
- Construction of a new MBTA facility to encourage improved visibility and access across the Square;
- Enhanced connections and transitions to neighboring areas, including scale transitions from the Square to BayState Road, and Olmsted mall link to the Emerald Necklace;
- Zoning to encourage development of appropriate buildings to enliven new public space, to support increased retail and services, and to give the Square an improved sense of spatial enclosure.

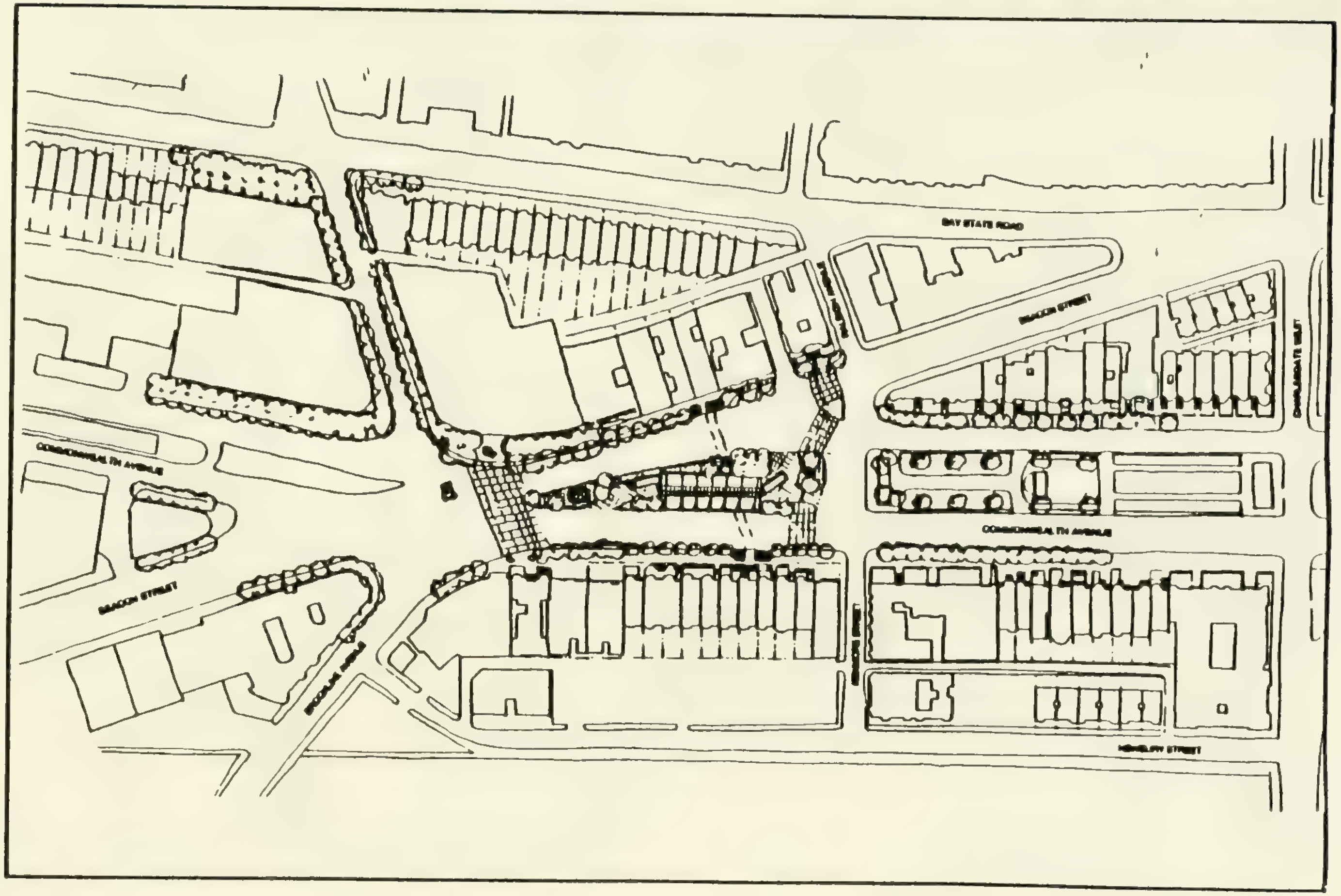
Elements of Private Environment:

- A balance of day- and night-time uses to ensure a lively public focus for the surrounding communities;
- Expanded street level retail and other active uses to enliven new public spaces;
- Off-street parking to serve all development;
- Height and massing guidelines for new development in the Square to provide a greater sense of spatial enclosure;
- Guidelines for building facades and signage to reinforce the Square's physical character, while also respecting the character of the adjacent Bay State Road historic area.

ii. Unify the Square

- Improve pedestrian connections between the north and south sides of the Square; control parking to improve the efficiency of traffic flow, to allow wider sidewalks and to shorten pedestrian crossing of traffic lanes.
- Redesign the MBTA bus station to allow direct visual connections between the north and south sides of the Square.

Improve pedestrian and visual connections between the north and south sides of the Square.



iv. Encourage Lively Streetscapes

- Reinvigorate the liveliness of retail uses in the Square -- restaurants, shops, and cinemas.

- Enhance the graphic and architectural quality of signs and building facades to reflect the lively character of the activities in Square

- Attractive shop and restaurant lights mark the Square to express the theme of the Square and mark its role as a gateway to the city and a meeting ground for nearby neighborhoods

Encourage active street-level uses, building facades, and signs to enhance the Square's attractiveness and unique lively character.

1. Potential for Development

Development can enhance the Square's urban design character.

Market Support

The restaurants, retail stores, and services derive a majority of their market support from the residential population of 17,900 (including 6,200 persons in group quarters - mostly students), and the employee population of 29,800 (including 20,800 white collar workers) within the one-half mile radius trade area around Kenmore Square. A majority of the retail, restaurant, and service trade is derived from customers walking in from nearby residences and places of employment. Very small increases are expected in the residential and student populations in the trade area, so that any significant increases in market support for businesses in Kemnore Square would come from increases in employment in the trade area. The dimensions of these increases in employment and their effects on development potential in Kenmore Square are discussed in the descriptions of the three development scenarios presented in the section that follows.

Development Potential

Development potential in Kenmore Square is limited. There are only two sites immediately available in the core business district, at Commonwealth Avenue and Deerfield Street, to support intensive commercial developments such as office buildings and hotels. Commercial development would increase the employment base in Kenmore Square and thereby provide a modest increase in customer support for restaurants, retail stores, and services. There also would be potential for a limited expansion of hotel capacity, and for entertainment uses such as cinemas. A third site is available at Deerfield Street and Bay State Road for a relatively small residential development. This would provide only a small increment of customer support for businesses in Kenmore Square.

Objectives for the Future

The future of development in Kenmore Square can be shaped by the following objectives;

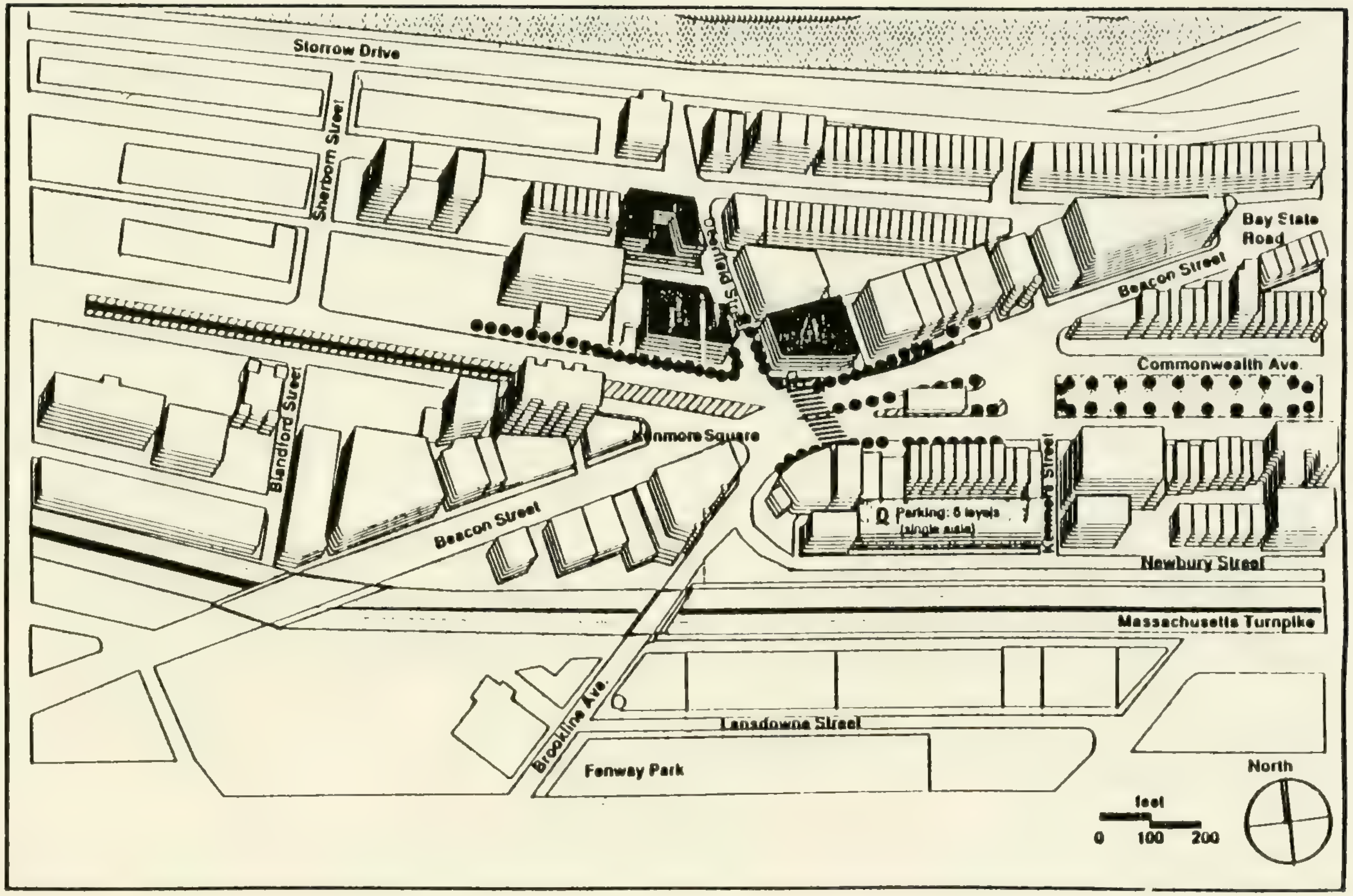
- Kenmore Square can live up to its potential as an important place within the city, with lively and active pedestrian environments;
- new development can be governed by urban design principles which protect or enhance its character; and
- the quality of the uses in new development can contribute to the character of the Square.

Scenario 1: Existing Sites

Maximum Floor Area Ratio: 4
Build-out:
Site A: 72,000 s.f, office, retail
Site B: 85,000 s.f, hotel /office, retail
Site C: 87,000 s.f, resid.ential
Maximum heights: 4-5 floors
Parking:
No parking on sites–development on B and C would displace 120 spaces; site D would provide 210 spaces
Economic Impact on the Square:
- Net addition to the Square of approx. 120,000 s.f.–an increase of less than 10% in total build-out
- Adds up to 500 new employees
- Adds support to existing stores and restaurants.

Urban Design Impact:
Unlikely to meet basic objectives of new public space, increased active uses, or better sense of enclosure.

Existing sites support limited development, smaller in scale than existing buildings.



Major development would change the character of the Square.

Scenario 3: Major development

Maximum Floor Area Ratio: 12

Build-out:
- Site A: 470,000 s.f, office, retail
- Site B: 440,000 s.f, hotel/office, retail
- Site C: 87,000 s.f, residential

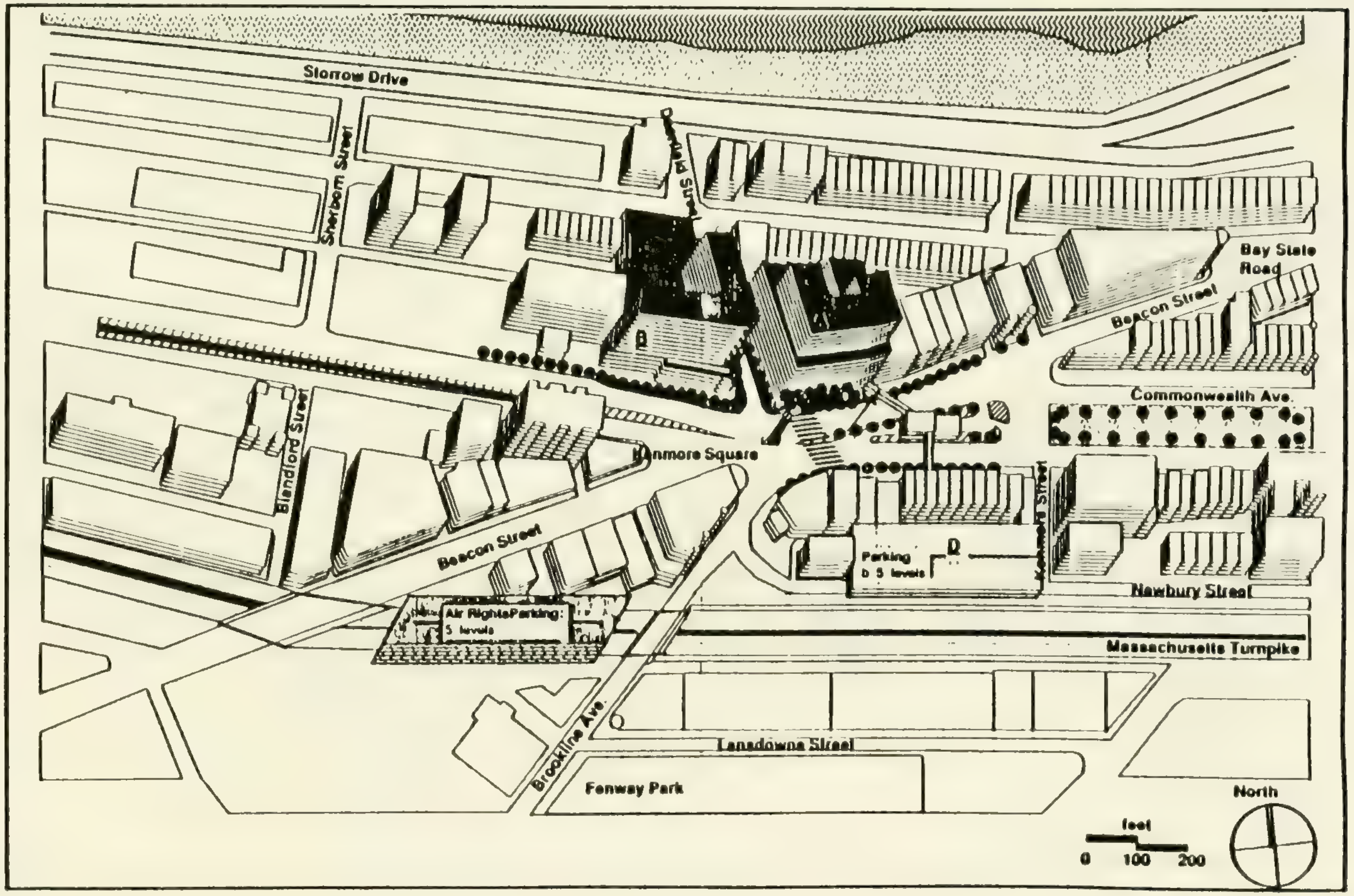
Maximum heights:
- Sites A-B: 14-18 floors
- Sites C: 4-5 floors

Parking: A combination of on and off-site parking for sites A & B, site D could provide 400 to 500 spaces (in 5 levels)

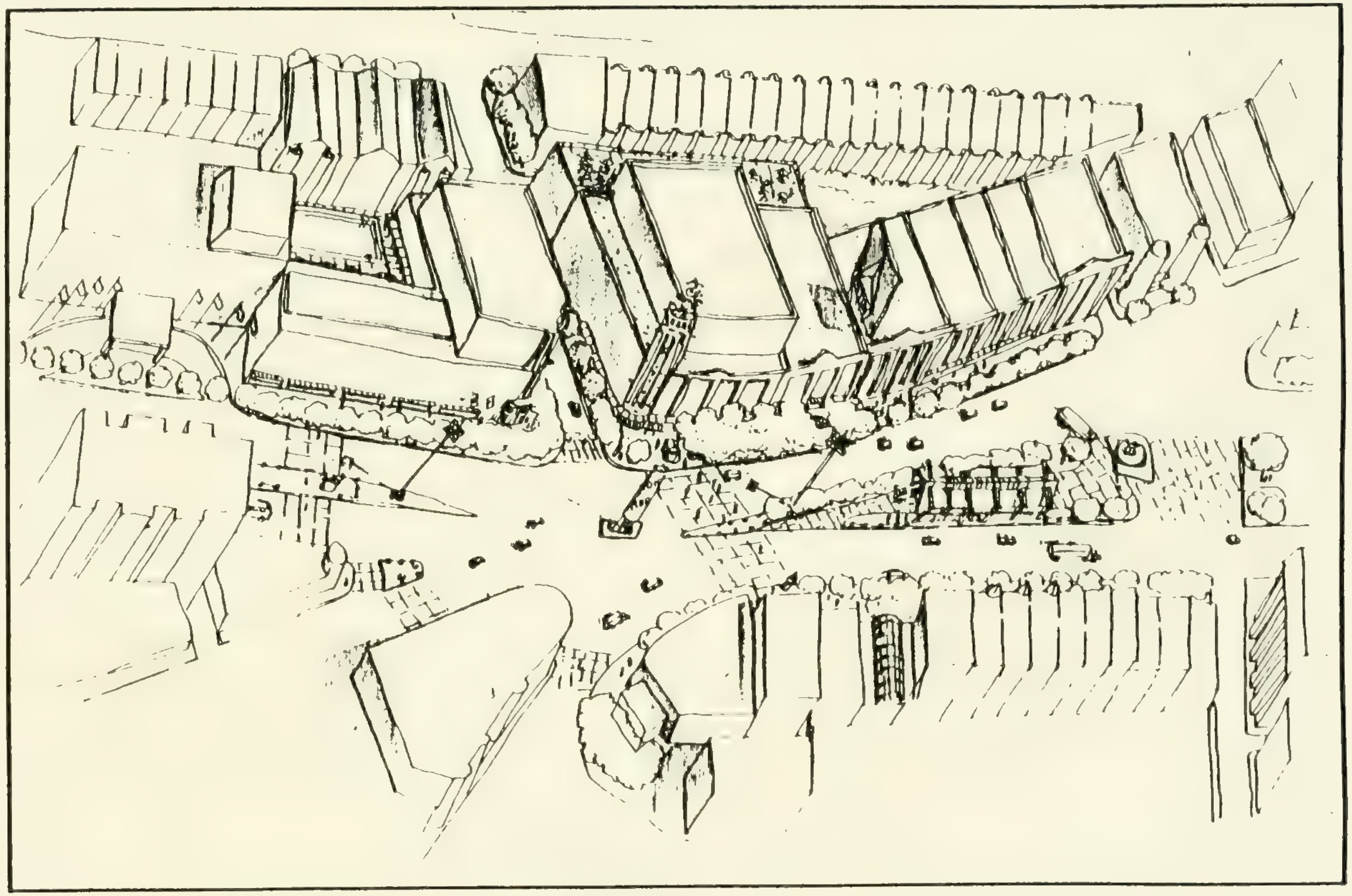
Economic Impact on the Square:
- Net addition of approx. 960,000 s.f.
- Add up to 3600 new employees
- Support new stores, restaurants

Urban Design Impact:

Major development will be similar to the new development at Kendall Square. Development can support a pedestrian bridge system in conjunction with an elevated plaza and an improved MBTA station.



Illustrative Study–new public space and related new buildings



CROSSTOWN PLAN

PROPOSED DEVELOPMENT PROJECTS

1991-1995

SUMMARY

Total Investment	$951.8m
Employment	
Construction Jobs	6,169
Permanent Jobs	7,129
Development Program	
Total Space	4,229,463
Medical Research Space	905,060
Linkage	
Housing Linkage	$12,751,400
Jobs Linkage	$2,550,280

CROSSTOWN PLAN

PROPOSED PROJECTS

1991-1995

PROJECT	SQUARE FEET	INVESTMENT	EMPLOYMENT	
			PERMANENT	CONSTRUCTION
Beth Israel Rabb Building Expansion	5,791	$2.0	11	10
New England Deaconess Palmer-Baker Bldg. Expansion	13,500	$3.0	61	12
Beth Israel NICU & Offices	17,000	$4.9	48	26
Brigham & Women's Clinical Support Facility	268,000	$48.5	529	489
Joslin Diabetes Center Research and Clinic Facility Expansion	84,230	$28.0	192	142
JMB/Macomber Olmsted Plaza, Phase I	300,000	$100.0	634	614
Children's Hospital 1295 Boylston St. Project	98,000	$30.0	193	179
New England Deaconess Clinical Facility	330,736	$140.0	652	604
Wentworth Institute College of Design & Construction, Phase I	81,726	$10.0	204	90
Mass. College of Pharmacy Science Building, Dining Facility, White Building Renovation	61,000	$10.0	178	44
Northeastern University Material Sciences Laboratory	120,000	$30.0	300	88
Boston University School of Management	500,000	$75.0	871	1,045
Beth Israel/Mass. College of Art Development	836,000	$137.8	989	1,006
Harvard School of Public Health Building II Expansion	100,000	$35.6	211	256
Brigham & Women's Tower Lobby Expansion	3,700	$0.9	4	7
Beth Israel Southeast Building	120,000	$40.0	237	219
Brigham & Women's Medical Research Building Office	28,280	$4.0	129	19
New England Deaconess Clinical Research Building	170,000	$68.7	359	310

PROJECT	SQUARE FEET	INVESTMENT	EMPLOYMENT PERMANENT	EMPLOYMENT CONSTRUCTION
Northeastern University Parking Garage/Ruggles St.	350,000	$13.3	3	64
Wentworth Institute College of Design & Construction, Phase II	55,000	$8.3	138	40
Northeastern University West Campus Housing	161,500	$24.2	4	118
Northeastern University Business Administration	73,000	$11.0	183	43
Wentworth Institute Dormitory	40,000	$6.0	1	29
JMB/Macomber Olmsted Plaza/Phase I-B	300,000	$100.0	634	614
Wentworth Institute College of Design & Construction, Phase III	141,000	$16.9	300	82
Mass. College of Pharmacy Science Building Addition and Parking	41,000	$3.7	63	21
TOTALS	4,299,463	$951.8	7,128	6,171

BOSTON REDEVELOPMENT AUTHORITY
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I. 1991 INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Beth Israel Rabb Building Expansion	5,791 (1376 rnvtn)	0	5,791 Clinical	10	11	$0	$0	$2.0	1991-II	1991-IV	Under Construction
New England Deaconess Palmer-Baker Bldg. Expansion	13,500	0	13,500 Admin	12	61	$0	$0	$3.0	1991-II	1992-I	Under Construction
Beth Israel NICU & Offices	17,000	0	11,333 Clinical 5,667 Office	26	48	$0	$0	$4.9	1991-II	1992-IV	Under Construction
Brigham and Women's Clinical Support Facility	268,000	0	268,000 clinical/ office	489	529	$268,000	$1,340,000	$48.5	1991-III	1993-IV	Under Construction
Joslin Diabetes Center Research and Clinic Facility Expansion	84,230	35,060	39,320 Admin&Conf 9,850 Clinical	142	192	$0	$0	$28.0	1991-IV	1993-III	Contract Documents
JMB/Macomber Olmsted Plaza, Phase I	300,000 (Renovation)	300,000	0	614	634	$200,000	$1,000,000	$100.0	1991-IV	1993-III	Contract Documents
1991 SUBTOTAL	688,521	335,060	353,461	1,292	1,476	$468,000	$2,340,000	$186.4			
CUMULATIVE TOTAL	688,521	335,060	353,461	1,292	1,476	$468,000	$2,340,000	$186.4			

II. 1992 INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Children's Hospital 1295 Boylston St. Project	98,000	0	98,000	179	193	$0	$0	$30.0	1992-II	1994-II	Schematic Design
New England Deaconess Clinical Facility	330,736	0	330,736 Clinical	604	652	$230,000	$1,150,000	$140.0	1992-II	1994-II	Design Development
Wentworth Institute College of Design & Cnstrctn., Phase I	81,726 (8,754) Renovation	0	81,726 Academic	90	204	$0	$0	$10.0	1992-III	1994-III	Schematic Design
Mass. College of Pharmacy Science Building, Dining Facility, White Building Renovation	61,000	0	40,000 Academic 15,000 Acad.(Rnvtn) 6,000 Dining	44	178	$0	$0	$10.0	1992-IV	1993-IV	Planning Phase
Northeastern University Material Sciences Laboratory	120,000	0	120,000 Academic	88	300	$20,000	$100,000	$30.0	1992-IV	1994-IV	Planning Phase
Boston University School of Management	500,000	0	348,000 Academic 152,000 Parking (300 Spaces)	1,045	871	$500,000	$2,500,000	$75.0	1992-IV	1995-I	Schematic Design
Beth Israel/Mass. College of Art Development	836,000	0	500,000 Clin/Med 336,000 Parking (960 Spaces)	1,006	989	$400,000	$2,000,000	$137.8	1992-IV	1995-II	Schematic Design
1992 SUBTOTAL	2,027,462	0	2,027,462	3,055	3,388	$1,150,000	$5,750,000	$432.8			
CUMULATIVE TOTAL	2,715,983	335,060	2,380,923	4,347	4,863	$1,618,000	$8,090,000	$619.2			

III. 1993

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Harvard School of Public Health Building II Expansion	100,000	100,000	0	256	211	$100,000	$500,000	$35.6	1993-I	1995-I	Planning Phase
Brigham & Women's Tower Lobby Expansion	3,700	0	3,700	7	4	$0	$0	$0.9	1993-I	1994-IV	Schematic Design
Beth Israel Southeast Building	120,000	0	120,000 Clinical	219	237	$120,000	$600,000	$40.0	1993-II	1994-IV	Schematic Design
Brigham and Women's Medical Research Building Office	28,280 Renovation	0	28,280 Office	19	129	$28,280	$141,400	$4.0	1993-II	1995-II	Planning Phase
New England Deaconess Clinical Research Building	170,000	170,000	0	310	359	$170,000	$850,000	$68.7	1993-II	1995-IV	Planning Phase
Northeastern University Parking Garage / Ruggles Street	350,000	0	350,000 1000 Spaces	64	3	$0	$0	$13.3	1993-III	1995-III	Planning Phase
1993 SUBTOTAL	771,980	270,000	501,980	875	943	$418,280	$2,091,400	$162.5			
CUMULATIVE TOTAL	3,487,963	605,060	2,882,903	5,222	5,807	$2,036,280	$10,181,400	$781.7			

IV. 1994

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Wentworth Institute College of Design & Cnstrctn., Phase II	55,000	0	55,000 Academic	40	138	$0	$0	$8.3	1994-I	1995-III	Planning Phase
Northeastern University West Campus Housing	161,500	0	161,500 650 beds	118	4	$0	$0	$24.2	1994-I	1996-I	Planning Phase
Northeastern University Business Administration	73,000 Renovation	0	73,000 Academic	43	183	$73,000	$365,000	$11.0	1994-II	1996-II	Planning Phase
Wentworth Institute Dormitory	40,000	0	40,000 (135 beds)	29	1	$0	$0	$6.0	1994-III	1996-III	Planning Phase
JMB/Macomber Olmsted Plaza/ Phase I-B	300,000 Renovation	300,000	0	614	634	$300,000	$1,500,000	$100.0	1994	1996	Schematic Design
1994 SUBTOTAL	629,500	300,000	329,500	844	959	$373,000	$1,865,000	$149.5			
CUMULATIVE TOTAL	4,117,463	905,060	3,212,403	6,066	6,766	$2,409,280	$12,046,400	$931.2			

V. 1995

INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
Wentworth Institute College of Design & Cnstrctn., Phase III	141,000 Renovation	0	141,000 Academic	82	300	$141,000	$705,000	$16.9	1995-I	1997-I	Planning Phase
Mass. College of Pharmacy Science Building Addition and Parking	41,000	0	25,000 Academic 16,000 Parking	21	63	$0	$0	$3.7	1995-II	1996-II	Planning Phase
1995 SUBTOTAL	182,000	0	182,000	104	363	$141,000	$705,000	$20.6			
CUMULATIVE TOTAL	4,299,463	905,060	3,394,403	6,169	7,129	$2,550,280	$12,751,400	$951.8			

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INSTITUTION	TOTAL SQUARE FEET	RESEARCH SQUARE FEET	OTHER SQUARE FEET	CNSTRCTN JOBS	PRMNT JOBS	LINKAGE JOBS	HOUSING	DEVELOPMENT COST (MILLIONS)	CNSTRCTN START	ESTIMATED COMPLETION	STATUS
JMB/Macomber Olmsted Plaza, Phase I	300,000 (Renovation)	300,000	0	614	634	$200,000	$1,000,000	$100.0	1991-IV	1993-III	Contract Documents
JMB/Macomber Olmsted Plaza/ Phase I-B	300,000 (Renovation)	300,000	0	614	634	$300,000	$1,500,000	$100.0	1994	1996	Design Development
JMB/Macomber Olmsted Plaza, Phase I-C	700,000	300,000	400,000 Garage (1156 Space)	687	637	$300,000	$1,500,000	$100.0	1997	1998	Design Development
JMB/Macomber Olmsted Plaza, Phase II	539,000	539,000	0	1,278	529	$539,000	$2,695,000	$175.0	2000	2000+	Schematic Design
CUMULATIVE TOTAL	1,839,000	1,439,000	400,000	3,192	2,434	$1,339,000	$6,695,000	$475.0			

CIRCUMFERENTIAL TRANSIT

DRAFT
CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

Prepared for the

Massachusetts Bay Transportation Authority

By

TAMS Consultants, Inc.

with

Comunitas
DMC Engineering
Howard/Stein-Hudson, Assoc.
Lea + Elliot
Sverdrup Corporation

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I. EXECUTIVE SUMMARY

The Circumferential Transit Feasibility Study was undertaken by the Massachusetts Bay Transportation Authority (MBTA) to examine short and long term transportation access improvements for destinations outside the regional core and to relieve congestion in downtown Boston on the radial rapid transit system. The primary objectives of the study include:

1. Improved access to and between major activity centers located on the fringes of downtown Boston and in the ten surrounding cities and towns located approximately five miles from the Central Business District.

2. Improved access to intercity and regional services such as Northeast Corridor Rail, commuter rail, and air transportation.

3. Relief of crowding in the central segments of the Green Line and the radial rapid transit lines such as the Red and Orange Lines.

4. Increased overall ridership on the MBTA system.

The primary study area was defined as the area within approximately five miles of the Boston Central Business District and encompassed the municipalities of Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Revere, Somerville, Watertown and Winthrop.

As a feasibility study, emphasis was placed on identifying those corridor improvements that are worthy of further more detailed consideration in an Alternatives Analysis. This next step, an Alternatives Analysis, would lead to a Draft Environmental Impact Statement, and is required by the federal Urban Mass Transit Administration before federal commitments are made to major transit capital investments.

While earlier studies have identified the desirability of circumferential transit services, this effort has been the first to provide in depth information on the costs and benefits of alternative corridor improvements. In addition, this study provides a unique, comprehensive look at the entire MBTA transit system in the year 2010. Thus, the Circumferential Transit Feasibility Study has required close coordination with the many other transportation and land use planning activities now underway in the area. The findings of this study should be invaluable in reaching decisions about circumferential corridor improvements, as well as decisions regarding other regional transit needs.

A. PLANNING PROCESS

The Circumferential Transit Feasibility Study produced three major categories of products as follows:

- Long range, major corridor investments worthy of further study in an Alternatives Analysis/Draft Environmental Impact Statement process, but not likely to be operational for fifteen to twenty years;

- Short range bus service improvements in the corridor that could be implemented in approximately the next five years, with a phasing strategy including immediate improvements; and

- Transportation System Management (TSM) improvements (generally, lower cost traffic and circulation actions) to assist bus movements in this very congested corridor, and capable of being implemented in the next ten years.

The process started with a number of activities designed to produce the information needed to identify these major categories of improvements. These activities included the following:

- Data collection to update population and employment forecasts to the year 2010, which subsequently became the basis for travel forecasting;

- A series of interviews with local area officials, regional planning agencies, transportation providers, and major employers and institutions in the corridor to identify current transportation concerns, anticipated future problems, and long range plans;

- An analysis of right-of-way opportunities in the circumferential corridor based on information developed in earlier studies and limited new field work;

- An analysis of existing travel conditions in the corridor, including the performance of both the street highway and transit networks, and
- A general public involvement process centered on Project Coordinating Committee (PCC) meetings conducted throughout the course of the study.

Once these steps were completed a "sketch plan" analysis was undertaken to identify future travel needs and specific transit corridor opportunities. This was followed by the generation of long range alternatives, short range bus service improvements, and short to medium range TSM improvements. Alternatives in each category were then separately evaluated. The findings of these three evaluation steps form the basis for the separate recommendations made in each category.

B. TRAVEL PATTERNS AND ACTIVITY CENTERS

The circumferential corridor study area encompasses a large number of existing and emerging activity centers surrounding the Boston core. These activity areas ring the core beginning with the University of Massachusetts on the southeast and ending with Logan Airport on the northeast. Traveling clockwise, the corridor connects the following major activity centers within the City of Boston:

- University of Massachusetts Boston Campus,
- Newmarket,
- Boston City Hospital/Boston University Medical School/Southeast Technology Square,
- Southwest Corridor Redevelopment Area,
- Northeastern University,
- Longwood Medical Complex, and
- Boston University.

Crossing the Charles River to Cambridge at roughly the Boston University Bridge, centers include:

- University Park Simplex Development,
- Massachusetts Institute of Technology (MIT),
- Kendall Square,
- East Cambridge Redevelopment Area, and
- Lechmere and North Point Redevelopment areas.

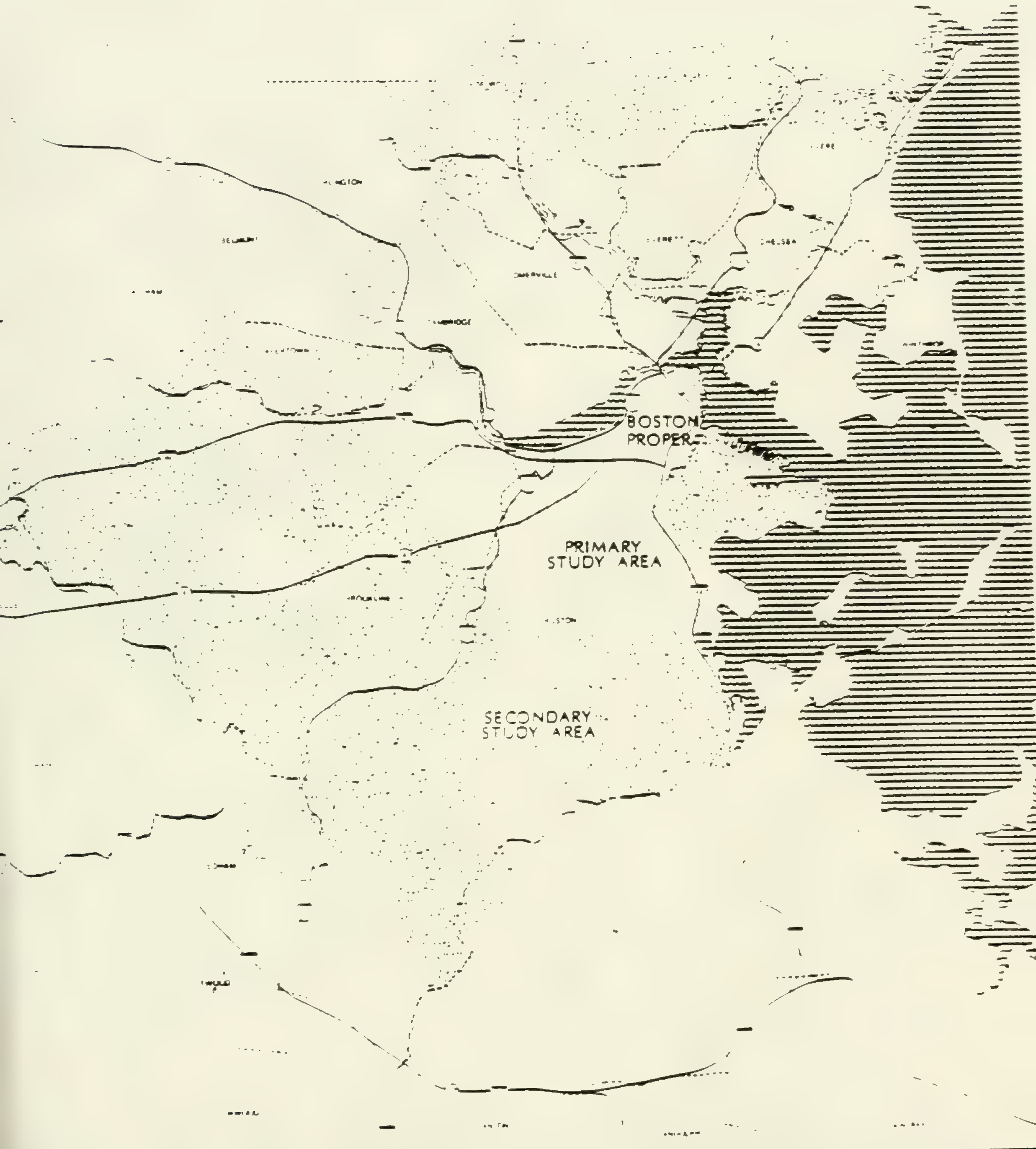
Continuing clockwise, back into the City of Boston, the corridor connects the Charlestown activity centers of Bunker Hill Community College and the Charlestown Navy Yard. Possible extension of the corridor northward through Sullivan Square, Everett and Chelsea and then south again to Logan Airport was also analyzed.

Within this same area the corridor crosses the majority of the MBTA's major radial transit facilities including the following:

- Red Line and proposed Old Colony commuter rail lines at the JFK/U Mass Station,
- Proposed Roxbury replacement transit service at Washington Street and Melnea Cass Boulevard,
- Orange Line and Southwest Corridor commuter rail lines at Ruggles Station,
- E Branch of the Green Line at Huntington Avenue and Ruggles Street,
- D and C Branches of the Green Line at Park Drive,
- B Branch of the Green Line and the Framingham commuter rail line at St. Mary's Street,
- Red Line at Kendall Square Station,
- Green Line at Lechmere Station, and
- Orange Line and all North Station commuter rail lines at Community College Station.

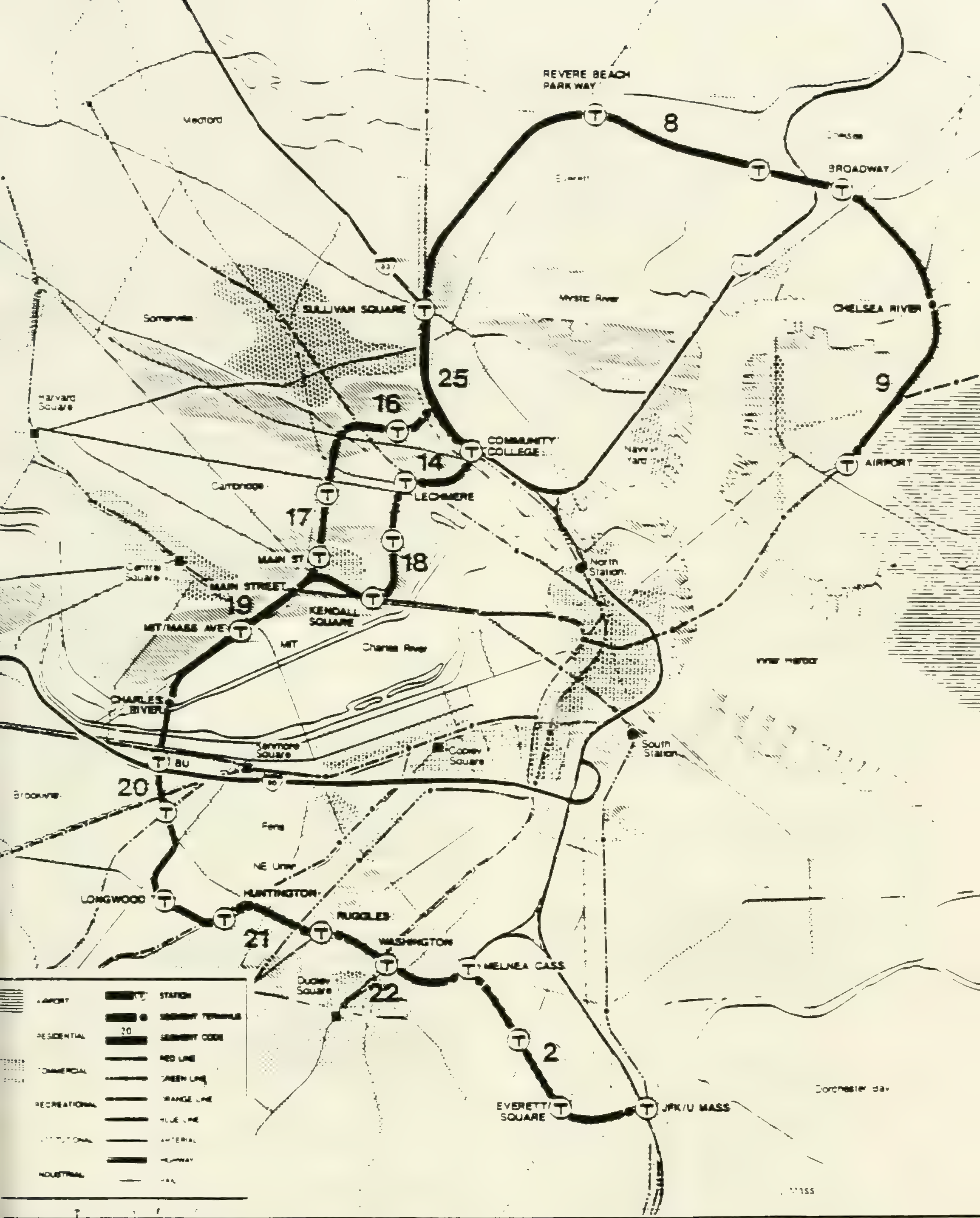
If extended to Logan Airport the corridor also crosses the Blue Line at Airport Station.

Development in key activity centers within the circumferential corridor is expected to intensify greatly by the year 2010. The study team identified a number of activity centers with significant growth potential, including Logan Airport, the Charlestown Navy Yard, the Lechmere/East Cambridge/North Point area, the Kendall Square area, the MIT/University Park area, the Longwood Medical area, the Southwest Corridor area, and the Boston City Hospital area.



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

Circumferential Study Corridor



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

Circumferential Corridor Land Use

The existing transportation system serving the circumferential corridor consists primarily of the regional highway and transit networks which radiate from the Boston core area. While three interstate highway segments, numerous expressways and arterials and all of the MBTA's rapid transit and commuter rail lines cross the corridor, no major highway or rapid transit line connects activity centers in the corridor. As a result, highway access requires travel to the core of Boston and then back out on very congested facilities, or traversing the corridor on generally local streets which carry volumes well beyond their design capacities.

Travel by transit is equally troublesome, requiring travel into the core on a radial line and then back out. These trips usually require a transfer at the most congested point in the system. Alternatively, travel between points in the corridor can be made by bus, but these routes tend to be slow and unpredictable as a result of the congested street segments over which they must operate. Approximately two dozen bus routes currently serve movement in the corridor and experience average daily ridership of nearly 95,000 trips.

C. SHORT AND MID RANGE IMPROVEMENTS

The findings of the analysis of existing corridor conditions and the forecast of future year 2010 conditions demonstrate the need for significant transit improvements. Actions need to be taken immediately to improve existing bus operations, preserve options for future corridor development, help shape corridor land use to assure a transit orientation, and take advantage of development potential in the corridor to help off-set the cost of future corridor investments.

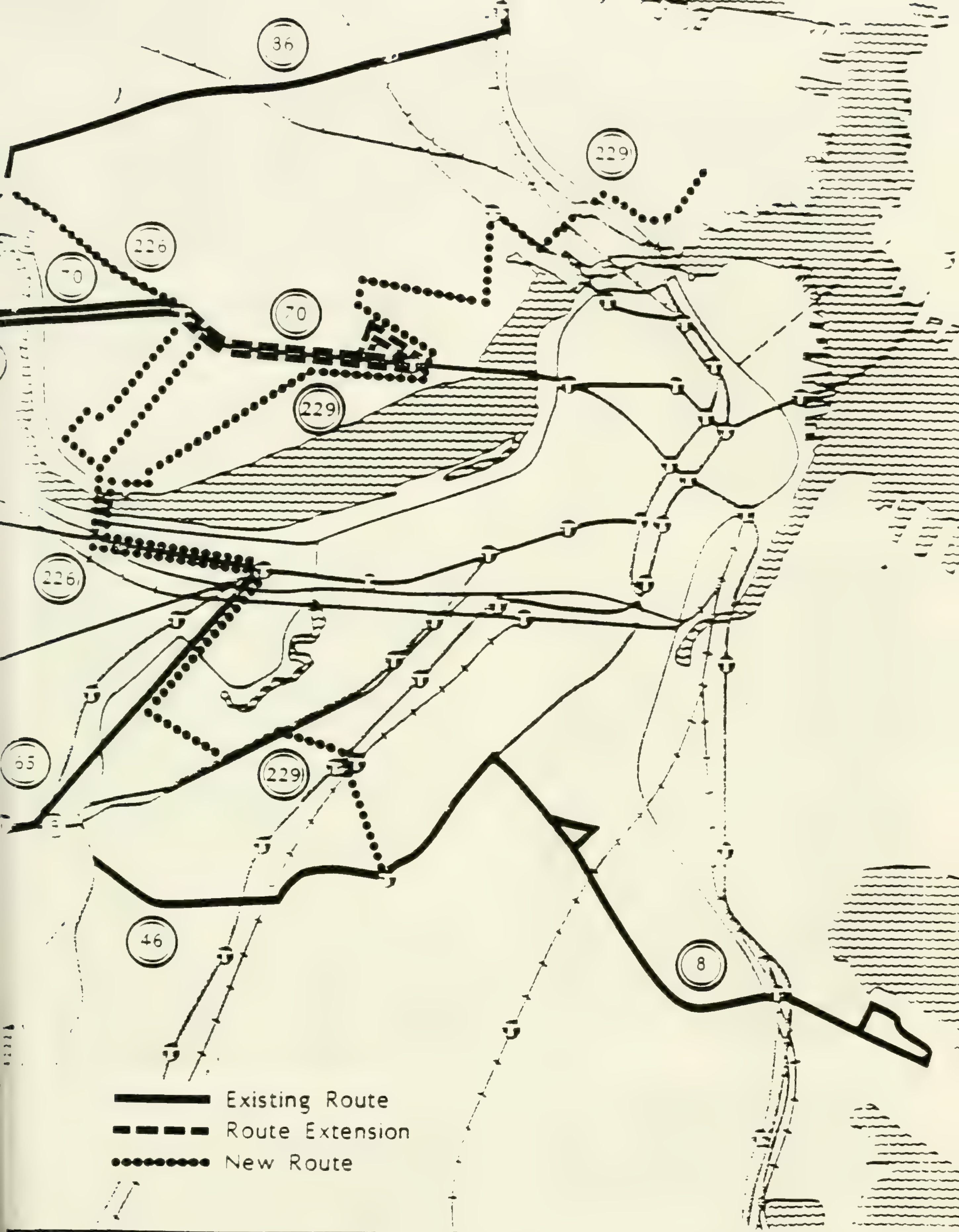
Given levels of existing development, transit ridership, and traffic congestion, actions are needed immediately to improve existing bus services and bus operations at key locations in the corridor. The Longwood area, Boston University area, Kendall Square and the Charlestown Navy Yard are the most important of the areas deserving attention over roughly the next five years.

1. Short Term Bus Improvements

The study identifies a number of recommended bus service improvements in the corridor. These improvements are designed to meet both existing travel needs and those that are likely to develop over the next five to ten years. In the case of the latter, the MBTA should monitor development and travel demand in a number of areas to determine the most appropriate timing of service additions. Areas requiring close attention include the Newmarket and Boston City Hospital areas in Boston, the University Park, Kendall Square and East Cambridge/Lechmere/North Point areas in Cambridge, and the Charlestown Navy Yard

Specific bus route recommendations include the following:

- **Route 8 & 46** - combining the Route 8, which connects Harbor Point to Ruggles Station and the Route 46, which connects Dudley Square to South Huntington/Heath Street would form one route connecting Harbor Point to South Huntington/Heath Street, with access to the Orange Line at Jackson Square Station.
- **Route 63** - this route, which connects Cleveland Circle to Central Square Station in Cambridge should be extended to Kendall Square Station
- **Route 64** - this route, which connects Oak Square in Brighton to Central Square Station in Cambridge should be discontinued in combination with the Route 86 extension to Oak Square, discussed below.
- **Route 65** - this route, which now connects Brighton Center to Kenmore Square should have improved service levels with shortened headways and extended service hours
- **Route 70** - this route, which currently runs between Waltham and Central Square Station in Cambridge, should be extended to Kendall Square Station.
- **Route 86** - this route, which connects Sullivan Station on the Orange Line to Harvard Square in Cambridge and Union Square in Allston should be extended to Oak Square in Brighton with the elimination of service on the Route 64 as discussed above.
- **New Route 226** - the addition of this route would provide new service between Kenmore Square and Harvard Square via Commonwealth Avenue and the Boston University Bridge. This new route would reduce ridership on the existing Routes 1 and 47 and help reduce current overcrowding. Implementation of the new Route 226 should be considered following a review of the potential service and operating impacts on the Routes 1 and 47



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

Recommended Short Term Bus Improvements

- **New Route 229** - this new route would connect Ruggles Station on the Orange Line to the Charlestown Navy Yard, via the Longwood Medical Area, University Park/MIT, Kendall Square, Lechmere Station, and Community College Station on the Orange Line. Initial implementation of this route could be accomplished by modifications to the existing Routes 63 and 47-A, as follows:

  Route 63: Extend the existing service from Cleveland Circle to Central Square Station in Cambridge and on to Kendall Square, Lechmere, Community College Station and the Charlestown Navy Yard.

  Route 47-A: Extend the existing short-trip from Boston City Hospital to Kenmore Square over the Massachusetts Avenue Bridge to MIT then via Vassar and Main Streets to Kendall Square.

- **Mass Turnpike Express Bus Routes** - four potential routes are identified for improving express bus services from the western suburbs to the Longwood area, emerging growth centers along the Charles River in Cambridge, and possibly the Charlestown Navy Yard. While changes to the Turnpike in the vicinity of the existing Allston interchange are desireable to support these routes, all could be implemented as demand warrants prior to any modifications. Consideration should be given to the Longwood and Kendall Square routes in the near future. Service to the University Park/MIT, East Cambridge/Lechmere, and Charlestown Navy Yard areas should be considered as development in these areas warrants.

2. Modest Cost Traffic Improvements

The Circumferential Transit Feasibility Study also identifies a number of modest cost traffic improvements capable of improving traffic flow and bus operations on existing streets and arterials in the corridor. Most of these improvements will require the MBTA to work closely with local municipalities and other State agencies.

Specific recommendations include the following:

- **Newmarket Area** - the MBTA should work closely with the Boston EDIC and the Boston Transportation Department to implement improvements to Massachusetts Avenue supportive of bus service improvements through this redevelopment area.

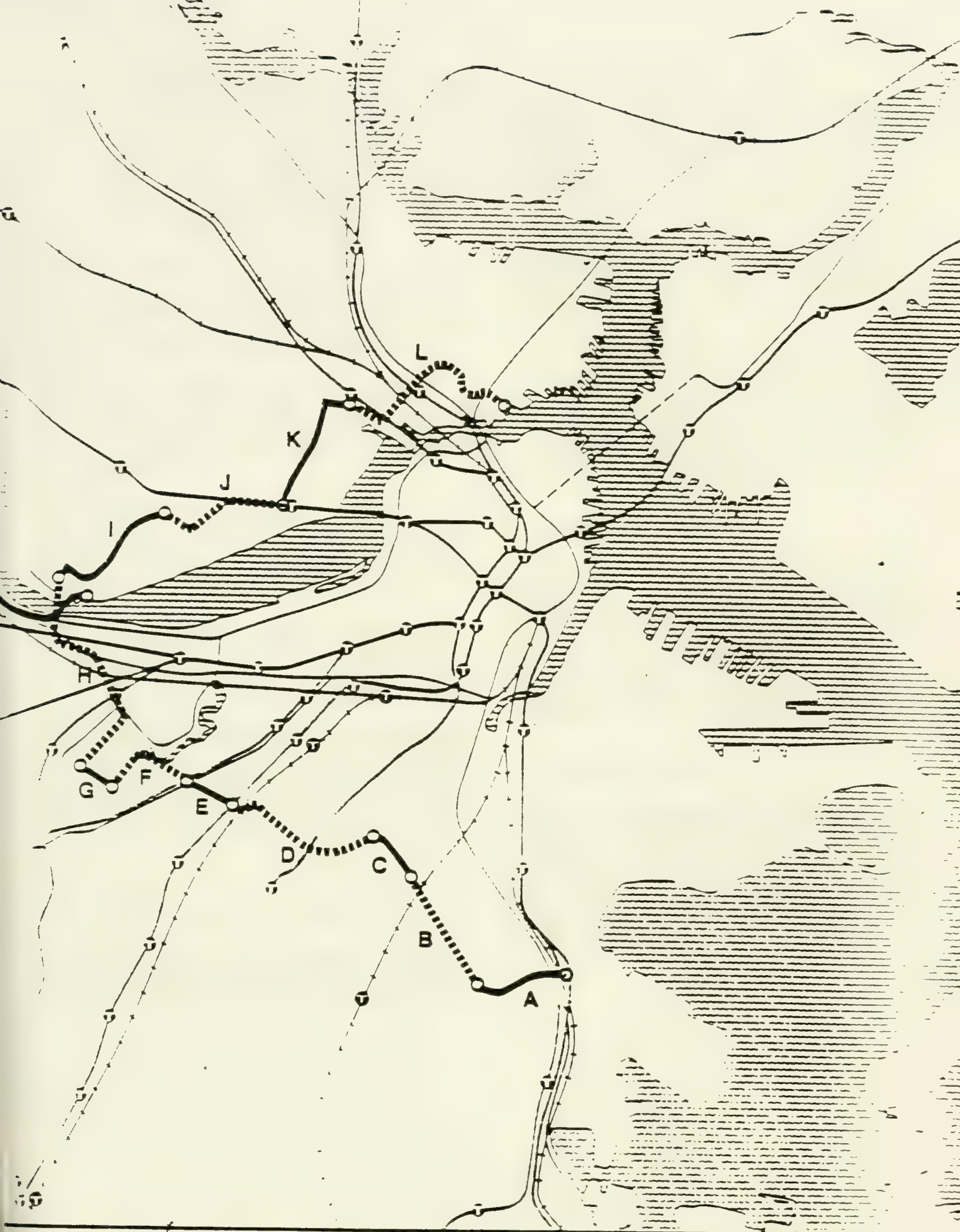
- **South Bay Interchange** - the MBTA should work closely with the State DPW and the Boston Transportation Department to implement improvements in the area as part of the Central Artery reconstruction supportive of expanded bus service in the Melnea Cass Boulevard/Massachusetts Avenue corridor.

- **Melnea Cass Boulevard** - the MBTA should monitor traffic conditions in the area to determine the appropriate timing for the development of the existing transit reservation as a bus facility. Consideration should also be given to the eventual conversion of the right-of-way for use by light rail or an aerial guideway for mini metro operation. Finally, land development along the corridor, including the addition of curb cuts, should be closely monitored to assure that bus operations will not be negatively impacted and that future development of the transit reservation is not compromised.

- **Ruggles Station Area** - the MBTA should work closely with the Boston Transportation Department and the Boston Redevelopment Authority to implement the series of improvements identified in the body of this report to improve bus operations through Ruggles Station. Development should be monitored to assure that the existing easement through the station and the adjoining development parcels is maintained for possible future light rail or mini metro development.

- **Ruggles Street** - Ruggles Street should be widened to a four lane cross section between Ruggles Station and Huntington Avenue. The existing transit reservation should be maintained with a minimum width of 32 feet. New development, including additional curb cuts, should be closely monitored to assure that future development of either a light rail line or mini metro tunnel is not impeded. In addition consideration should be given to the possibility that this segment will include a tunnel portal for the transition of a light rail line from surface to subway.

- **Greater Longwood Area** - the MBTA should work with the City of Boston, MASCO and the Metropolitan District Commission (MDC) in the implementation of the series of recommended traffic improvements in the overall area from Huntington Avenue to the Boston University Bridge.



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

TSM Corridor Segments

- **Allston Interchange of the Mass Turnpike** - the MBTA should work with the Turnpike Authority and the Executive Office of Transportation and Construction to allow bus use of the truck route now under study. This facility could allow express buses to exit the Turnpike and use the Grand Junction Bridge to reach destinations in Cambridge.

- **University Park** - the MBTA should work with the City of Cambridge to implement improvements for the operation of buses in the University Park/MIT area as part of the proposed street changes in the area.

- **Kendall Square** - the MBTA should work with the City of Cambridge and the Cambridge Redevelopment Authority to implement improvements for bus operations in the general area.

- **Lechmere Station** - the design of the new station should provide for the smooth movement of buses between Kendall Square and Community College Station on the Orange Line and the Charlestown Navy Yard.

- **Gilmore Bridge** - the MBTA should work with the Cities of Boston and Cambridge and the State DPW in a study to determine appropriate traffic flow improvements in the general area.

- **Charlestown Navy Yard** - the MBTA should work with the City of Boston, the National Park Service and the New England Aquarium to implement the identified improvements needed to allow for the smooth operation of buses through the Charlestown Navy Yard.

D. LONG RANGE IMPROVEMENTS

The study identifies and evaluates a number of alternative long range improvements in the corridor. Five generalized transit technologies are considered. Three of these technologies, conventional diesel bus, light rail and intermediate rapid transit (Blue Line) are currently operated by the MBTA, and two of the technologies, dual propulsion (electric and diesel) guided bus and automated people mover would be new to the MBTA system. Because of the corridor characteristics of constrained rights-of-way and likely short station spacings with high volumes of transfers between lines, heavy rail rapid transit such as Red and Orange Line vehicles and commuter rail are inappropriate.

Six initial alternatives were generated with the objective of defining a wide range of possible corridor options. Based on the results of the first pass evaluation long range alternatives were refined into eight distinct options, and a detailed evaluation and cost effectiveness analysis were conducted. Alternatives include the following:

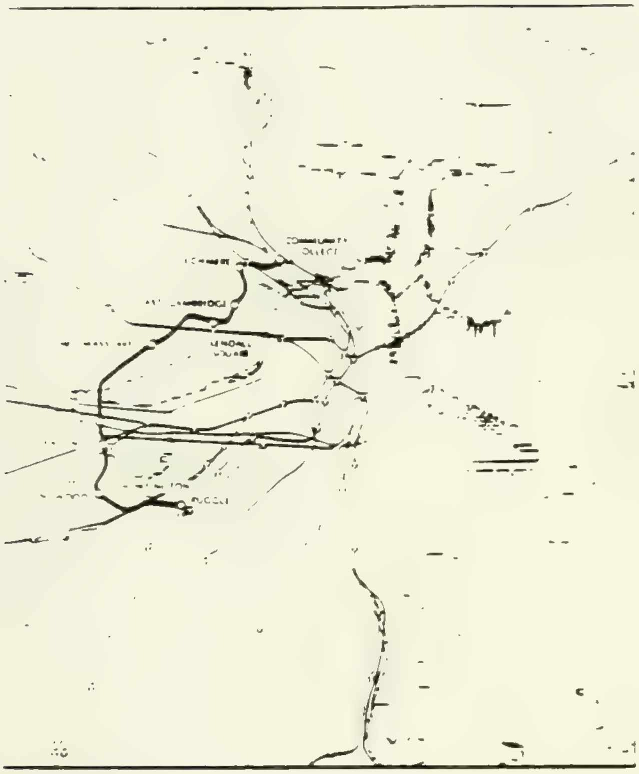
1. Alternative 1 - Baseline

This alternative is the baseline or "no action" 2010 design year transit service in the circumferential corridor. It provides a basis of comparison for the seven "action" alternatives. While this alternative did not include any improvements in the circumferential corridor, it did include a number of planned radial transit improvements such as the restoration of Old Colony rail service.

2. Alternative 2 - TSM

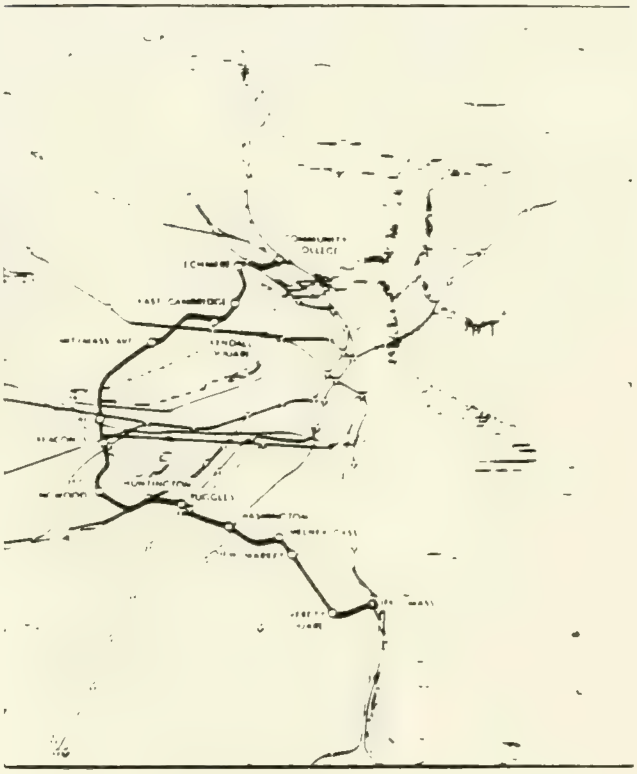
The TSM or Transportation Systems Management alternative consists of low cost traffic improvements, the addition of new bus routes and modification of existing bus routes, as described in the earlier section. The TSM alternative provides the basis for comparison of the cost effectiveness of the major investment options.

3. Alternative 3C - Core LRT



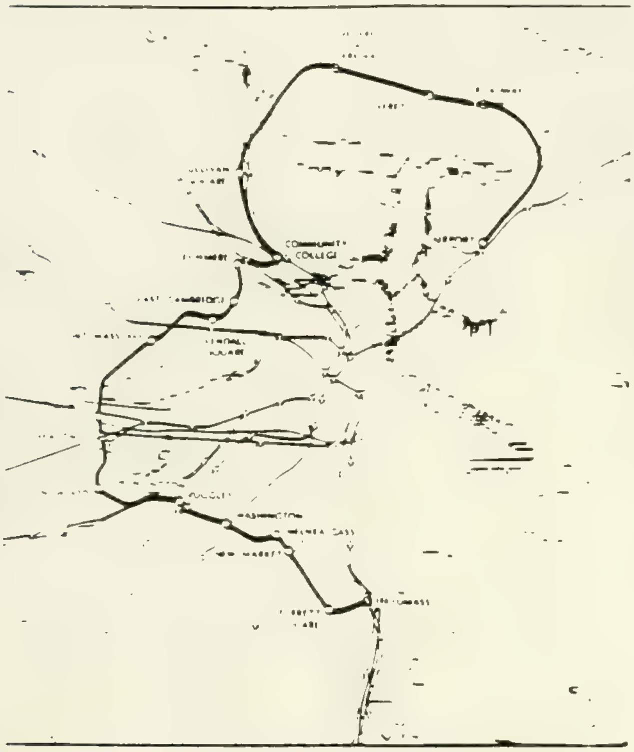
This alternative is the simplest of the light rail options and would consist of a single line connecting Ruggles Station on the Southwest Corridor/Orange Line to Community College Station on the northern leg of the Orange Line. It would consist of approximately 5.1 miles of double-track light rail, predominantly in subway. A total of ten new stations would be constructed, two at-grade, one on aerial structure, and seven in subway. Also included is an expanded maintenance and storage facility at Lechmere and new commuter rail platforms on the Framingham Line near St. Mary's Street and on all North Station lines at Community College.

4. Alternative 3D - JFK/U Mass Core LRT



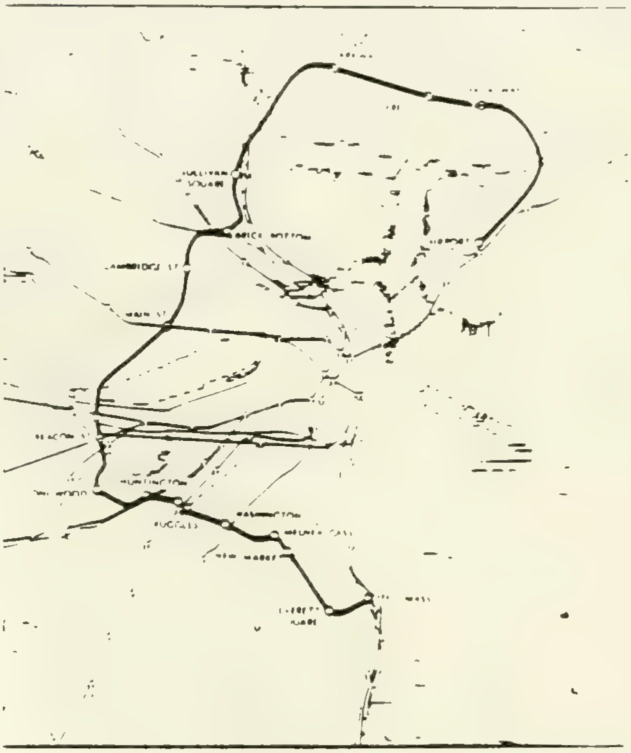
This alternative includes the core alignment of alternative 3C and adds an extension from Ruggles Station to the JFK/U Mass Station on the Red Line. This extension produces a total double-track line length of 7.3 miles. The total number of stations would increase to 14, with four at-grade, two on aerial structure and eight in subway. New commuter rail platforms would be added near St. Mary's Street on the Framingham Line, at Community College on all North Station lines, and at JFK/U Mass on the Old Colony Line. Because of the line's greater length and the lower rider demand on the outer portions, two light rail lines would be operated. One would run from JFK/U Mass to Kendall Square, and one would connect Ruggles Station to Community College.

5. Alternative 3E - JFK/U Mass to Airport via Community College



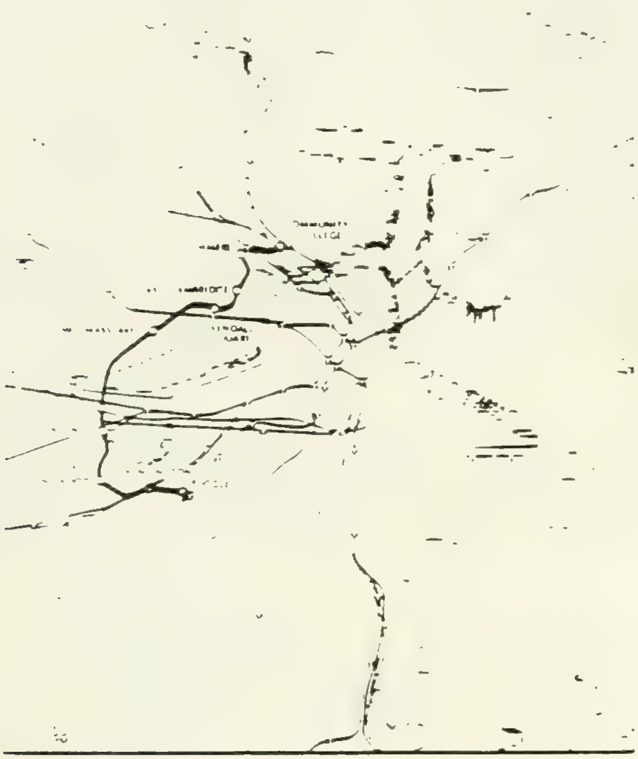
This alternative would provide light rail service the full length of the corridor from JFK/U Mass to Logan Airport. It would be essentially the same as Alternative 3D from JFK/U Mass to Community College. From Community College Station this alternative would extend circumferential service north along existing rail facilities through Somerville, Everett, and Chelsea, then southward to East Boston and terminate at Logan Airport. This alternative consists of a total of 13.3 double track miles, with nearly all of the additional six miles compared to Alternative 3D being at-grade. The total number of stations would increase to 19, with nine at-grade, two on aerial structure, and eight in subway. Because of the length of the route three light rail lines would be operated. One would serve the entire corridor from JFK/U Mass to Logan Airport. A second would operate between JFK/U Mass and Kendall. And a third would connect Ruggles Station to Community College Station.

6. Alternative 3F - JFK/U Mass to Airport via Grand Junction



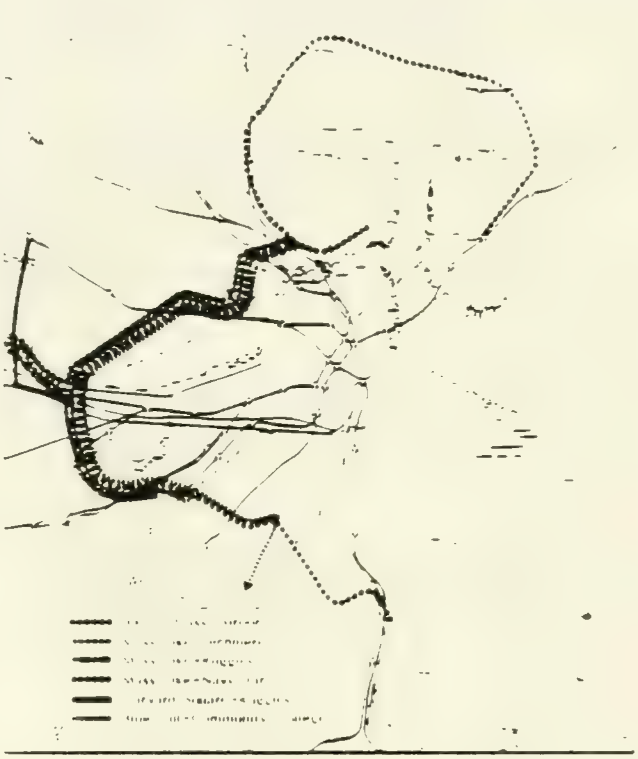
This alternative would provide light rail service the length of the corridor from JFK/U Mass to Logan Airport, using a slightly different alignment than that described for Alternative 3E. Under this option the Grand Junction Railroad would be utilized for its entire length from the Charles River to Sullivan Square Station on the Orange Line. This modified alignment consists of 12.7 double track miles. A total of 18 stations would be included, nine at-grade, two on aerial structure, and seven in subway. New commuter rail platforms would be constructed near St. Mary's Street on the Framingham Line, near the O'Brien Highway on the Fitchburg Line, at Sullivan Square on the North Shore, Lowell and Haverhill Lines, and at JFK/U Mass on the Old Colony Line. As with Alternative 3E, three different routes would serve the corridor. One route would run the entire corridor from JFK/U Mass to Logan Airport. One would provide service between Ruggles Station and Sullivan Square Station. And one would connect JFK/U Mass Station to Main Street in Cambridge.

7. Alternative 5D - Mini Metro Core Alignment



The initial analysis of fully grade separated, medium capacity rapid transit options indicated that only the central portion of the corridor had potential year 2010 ridership large enough to warrant this high capital cost alternative. As a result, the detailed analysis was limited to an alternative running from Ruggles Station to Community College Station. The line would consist of approximately 5.1 miles of double-track guideway, all in subway except for a limited section between Lechmere and Community College. A total of ten stations would be constructed, one on aerial structure, and nine in subway. Also included is a new maintenance and storage facility north of Community College Station, and new commuter rail platforms on the Framingham Line near St. Mary's Street and on all North Station lines at Community College.

8. Alternative 6 - Guided Bus



Opportunities for low cost guided bus development are very limited in the core segment of the circumferential corridor between Ruggles Station and Community College Station. However, outside the core area, significant opportunities exist for guided bus development on both the extensions to JFK/U Mass from Ruggles and Logan Airport from Community College. Thus, the core corridor requires significant subway construction, similar to that identified for the light rail and mini metro alternatives. For purposes of analysis the guided bus alternative was defined with guideway development throughout the length of the corridor from Ruggles Station to Logan Airport. Therefore, in this area it is similar to the light rail system described in Alternative 3E. A total of 13.3 double track guideway miles would be included, with over four miles of subway, limited sections on aerial structure, and the balance at grade. A total of 19 stations would be included, with nine at-grade, two on aerial structure, and eight in subway. Guided bus vehicle storage and maintenance was assumed to be accommodated by expansion of existing MBTA bus bases. Six separate bus routes would operate in the corridor

E. EVALUATION OF LONG RANGE IMPROVEMENTS

The alternatives were subjected to a detailed evaluation and cost effectiveness analysis using a year 2010 design horizon. The results are summarized in the accompanying table. Key findings with regard to the major investment alternatives include:

- **Ridership** - all major build alternatives generate high levels of ridership ranging from 100,000 to 150,000 boardings per day. Of this ridership approximately 60 percent is diverted from existing rail lines and bus routes, and 40 percent are new riders.

- **Green Line Impacts** - all major build alternatives produce substantial reductions in Green Line peak load volumes between Park and Boylston Stations. Reductions average roughly 20 percent compared to the TSM Alternative.

- **Commuter Rail Impacts** - improved service in the circumferential corridor produces large increases in commuter rail ridership, particularly for routes serving North Station.

- **Travel Time Savings** - all major build alternatives produce major travel time savings for corridor transit users.

- **MBTA System Requirements** - most of the major build alternatives produce savings in reduced vehicle requirements for buses, Red Line cars and Green Line cars.

- **Service to Users with Special Needs** - impacts vary depending on the technology. The high platform Mini Metro Alternative provides the most improved accessibility for wheel chair users.

- **Reliability** - all major build alternatives significantly improve the reliability of transit service in the corridor. Greatest improvement would occur with the fully grade separated Mini Metro Alternative.

- **Implementation** - all build alternatives require major investments and construction. Implementation and phasing are probably easiest for the Light Rail Alternatives. Both the Mini Metro and Guided Bus Alternatives introduce new technologies to the MBTA system.

- **Environmental** - all major build alternatives produce reductions in corridor auto travel and result in reductions in vehicle emissions and energy consumption. Noise impacts are generally minimal because of the predominance of subway alignment.

- **Land Use** - all major build alternatives require minimal right-of-way acquisition. Significant development impacts are likely from all the options.

- **Capital Costs** - all build alternatives require major investments exceeding $1 Billion in 1988 dollars.

- **Operating Costs** - all major build alternatives result in overall savings in MBTA system operating costs compared to the TSM Alternative.

- **Cost Effectiveness** - with the exception of the Guided Bus Alternative, all produce ratios within UMTA thresholds for consideration in an Alternatives Analysis.

F. LONG RANGE ALTERNATIVES RECOMMENDATION

The results of the evaluation of the long range alternatives, indicate that a number of options appear to provide highly cost effective solutions to meet corridor travel needs. In general, it is clear that without a major investment in the corridor traffic conditions and transit operations will deteriorate significantly by the year 2010. Growth in emerging activity centers in both Boston and Cambridge will be restrained without a major investment in the corridor. In addition, if the Circumferential Line is not built by the year 2010 costly improvements may be necessary to deal with capacity problems on key links of both the Red and Green Lines. Finally, opportunities exist both for transit line right-of-way and for the shaping of new development if planning for a Circumferential Line proceeds in a timely manner.

Investment in a major transit facility in the circumferential corridor will require a number of additional steps and actions. Should decisions be made to proceed, more in depth community involvement must be undertaken; refinement and more in depth analysis of corridor alternatives must occur; further study of land use and environmental issues will be required; actions must be taken to preserve existing right-of-way, and opportunities

should be pursued to secure funding and joint development possibilities. The most important next step is to begin a formal Alternatives Analysis and Environmental Impact Statement process.

The results of the long range alternatives evaluation indicate that both the Light Rail and Mini Metro Alternatives appear promising and are worthy of further study. While the Light Rail Alternatives produce the lowest cost effectiveness ratios, the Mini Metro Alternative is nearly as attractive. In addition, the latter produces the shortest travel times, would be fully accessible to special needs users, and results in lower operating costs per passenger compared to the Light Rail Alternatives. On the negative side, it has a higher capital cost, would introduce a new technology to the MBTA system, and would not be as easy to implement in phases as compared to the other alternatives.

A distinct advantage of the Light Rail Alternatives are their ability to operate on lower cost non-grade separated right-of-way outside the core alignment. This is very important if the extensions from Ruggles to JFK/U Mass or northward from Community College are seriously considered.

The Guided Bus Alternative produces cost effectiveness measures much higher than those for any of the other alternatives. This is primarily a result of the high costs of right-of-way development and the lower ridership. The former occurred because of the extensive subway segments included in the feasibility study. The guided bus, however, has significant advantages related to Circumferential Line phasing and its impact on reducing Green Line volumes. As a result it is recommended that the cost and ridership impacts of a more modest approach be explored.

Year 2010
Long Range Alternatives Summary Evaluation

Criteria	2 TSM	3C Core LRT	3D Core LRT UPK/U Mass	3E LRT UPK/U to Airport
Daily Corridor Ridership	9,000	102,000	120,000	146,000
Daily System Wide Ridership Compared to 1987	+ 215,000	+ 275,000	+ 277,000	+ 287,000
Travel Time Savings Compared to Baseline Alternative	157,000 min./day	749,000 min./day	842,000 min./day	1,137,000 min./day
Service to Users With Special Needs	Minor improvement	Major improvement if Green Line is made accessible	Major improvement if Green Line is made accessible	Major improvement if Green Line is made accessible
Reliability	Fair to poor	Good	Good	Good
Implementation	Simple improvements, easily undertaken	Major project, no new technology	Major project, no new technology, can be phased	Major project, no new technology, can be phased
Change in Regional Vehicle Travel Compared to Baseline Alternative	- 24,000 miles/day	- 379,000 miles/day	- 385,200 miles/day	- 465,000 miles/day
Noise Impacts	Increased diesel bus operations.	Little or no change with mostly subway operation.	Minor increase on surface segments.	Minor increase on surface segments.
Land Use Impacts	None	Major influence in core segment.	Major influence in core segment, stimulus for development on outer links	Major influence in core segment, stimulus for development on outer [illegible]
Social Impacts	Minor positive benefit.	Major service improvement to low income neighborhoods and employment opportunities.	Major service improvement to low income neighborhoods and employment opportunities.	Major [illegible] improvement to low [illegible] neighborhoods [illegible] employment opportunities.
Corridor Capital Costs (1988 $)	$19,000,000	$1,033,000,000	$1,245,000,000	$1,37[illegible]
Annual Operating Costs Compared to Baseline Alternative (1988 $)	+$17,000,000	- $4,000,000	- $10,000,000	- $1[illegible]
Cost Effectiveness (Standard Federal Index)	Base for comparison	$3.78	$4.18	[illegible]

Year 2010
Long Range Alternatives Summary Evaluation
(continued)

Criteria	3F LRT (JFK/U Mass to Airport via Grand Junction RR)	5D Mini Metro	6 Guided Bus
Corridor Ridership	119,000	103,000	114,000
System Wide dership Compared o 1987	+ 278,000	+ 276,000	+ 234,000
Travel Time Savings ompared to Base- ne Alternative	896,390 min./day	753,000 min./day	1,115,000 min./day
rvice to Users With Special Needs	Major improvement if Green Line is made accessible	Major improvement	Major improvement
Reliability	Good	Excellent	Good
mplementation	Major project, no new technology, can be phased	Major project, introduces new technology	Major project, introduces new technology, can be phased
hange in Regional ehicle Travel Compared to Base- ne Alternative	- 434,120 miles/day	- 382,000 miles/day	- 157,000 miles/day
se Impacts	Minor increase on surface segments	No impact, all subway	Modest impact with increase in diesel bus operations
nd Use Impacts	Major influence in core segment, stimulus for development on outer links.	Major influence in core.	Major influence in core segment, stimulus for development on outer links
cial Impacts	Major service improvement to low income neighborhoods and employment opportunities.	Major service improvement to low income neighborhoods and employment opportunities.	Major service improvement to low income neighborhoods and employment opportunities
rridor Capital osts (1988 $)	$1,180,000,000	$1,145,000,000	$1,384,000,000
nual Operating Costs mpared to Baseline ternative (1988 $)	- $10,000,000	- $5,000,000	+ $13,000,000
st Effectiveness tandard Federal dex)	$3.65	$4.39	$19.22

II. INTRODUCTION

The Circumferential Transit Feasibility Study was initiated by the Massachusetts Bay Transportation Authority (MBTA) in early 1987 to examine short and long term transportation options to improve access to destinations outside the regional core and relieve congestion in downtown Boston on the radial rapid transit system. The primary study focus was the area within approximately five miles of the Boston Central Business District and encompassed the municipalities of Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Revere, Somerville, Watertown and Winthrop. Figure II-1 illustrates the general study area.

The study of circumferential improvements has wide ranging implications for the entire MBTA system, since nearly every major MBTA service is impacted by improvements in the corridor. Each of the four existing branches of the Green Line, and both legs of the Orange and Red Lines are intercepted and thus, impacted by the corridor. Depending on the length of the corridor to the northeast the Blue Line might also be affected. Commuter rail lines from the north shore, northwest, west, and southwest, as well as the planned Old Colony services to the south shore are similarly impacted. In addition, the corridor is now served by a number of surface bus lines, many of which experience the highest ridership of all MBTA bus services.

Thus, the Circumferential Transit Feasibility Study has required close coordination with the many other transportation and land use planning activities now underway in the area. In addition an MBTA system-wide analysis of transit services and impacts in the year 2010 was conducted. The findings of this work provide much new and extremely valuable information regarding the characteristics and conditions of transit system operation twenty years into the future. The study is unique in that for the first time in many years a basis is available for the MBTA to formulate a long range, comprehensive plan.

Boston, like many major metropolitan areas, has a large number of trip generators located beyond the central core. These activity centers ring the core area beginning with the University of Massachusetts on the southeast and ending with Logan Airport on the northeast. Traveling clockwise, major existing and emerging centers in the City of Boston include:

- University of Massachusetts Campus/Harbor Point,
- Newmarket area,
- Boston City Hospital/Boston University Medical School/Southeast Technology Square,
- Southwest Corridor Redevelopment Area
- Northeastern University,
- Longwood Medical Complex, and
- Boston University

Crossing the Charles River to Cambridge at rough the Boston University Bridge, centers include

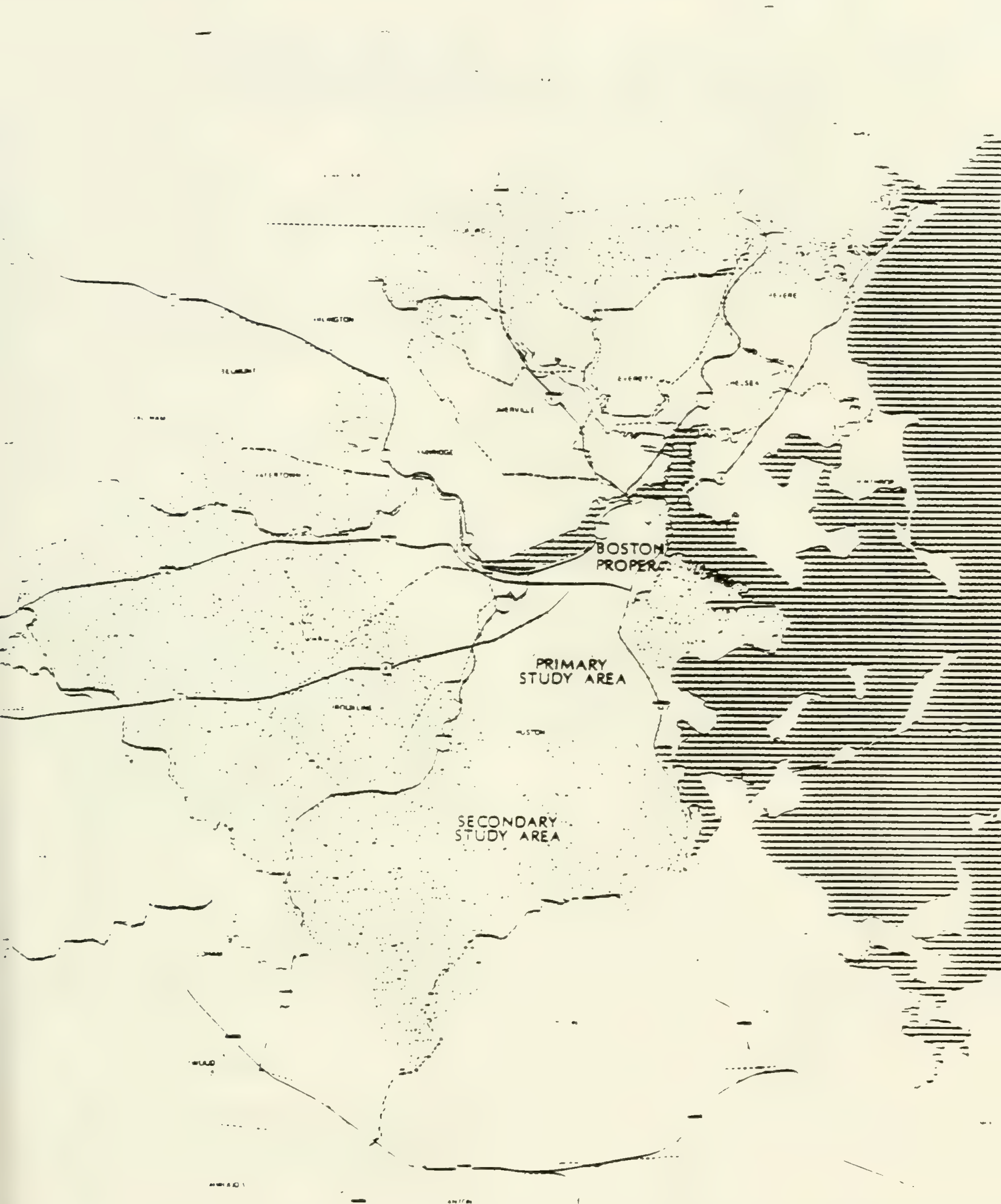
- University Park Simplex Development
- Massachusetts Institute of Technology (MIT
- Kendall Square,
- East Cambridge Redevelopment Area, and
- Lechmere/North Point Redevelopment areas

Continuing clockwise, back into the City of Boston the corridor connects the Charlestown activity centers of Bunker Hill Community College and the Charlestown Navy Yard. Northward from Charlestown the corridor continues through Sullivan Square, Somerville, Everett, Chelsea and then south again through East Boston to Logan Airport.

Boston, however, is unique in the density and level of employment activity contained in these close-in centers. In addition, many of these areas particularly those north of the Charles River and in Charlestown are experiencing very rapid growth commercial, retail and residential development

The capacity of the regional highway network and local arterial system serving many of these areas near saturation, with only modest improvements capacity foreseen in the future.

The MBTA rail system, while serving many of these areas, consists totally of radial lines focused on the central downtown core. Thus, most transit trips to these centers require riders to pass through transfer in the most congested segments of the system. The MBTA has undertaken recent and on-going expansions and improvements to the rail lines, such as the Red Line Northwest extension and Orange Line relocation, platform lengthening both the Red and Orange lines, and restoration Old Colony commuter rail service. However anticipated that implementation of these pro



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE -1
Circumferential Study Corridor

may not be sufficient to relieve the ever increasing congestion in the central system and improve the trip distribution to the areas surrounding the downtown core.

A. STUDY PURPOSE

Given these conditions, the MBTA undertook the Circumferential Transit Feasibility Study with the following objectives:

1. Improved access to and between major activity centers in the fringes of downtown Boston and the ten surrounding cities and towns located approximately five miles from the central business district.
2. Improved access to intercity and regional services such as Northeast Corridor Rail, commuter rail, and air transportation.
3. Relief of crowding in the central segments of the Green Line and the radial rapid transit lines such as the Red and Orange Lines.
4. Increased overall ridership on the MBTA system.

As a feasibility study emphasis was placed on identifying those corridor improvements that are worthy of further more detailed analysis. The objective was to identify, describe and then evaluate a broad range of options for the purpose of recommending alternatives for consideration in an Alternatives Analysis. The next step, an Alternatives Analysis, would lead to a Draft Environmental Impact Statement, and is required by the federal Urban Mass Transit Administration before federal commitments are made to major capital investments.

Since the Circumferential Transit Feasibility Study is long range in nature, a time frame of the year 2010 was chosen as the primary focus of analysis. In addition, consideration was given in the study to bus service and traffic operations improvements which might be implemented in the near term.

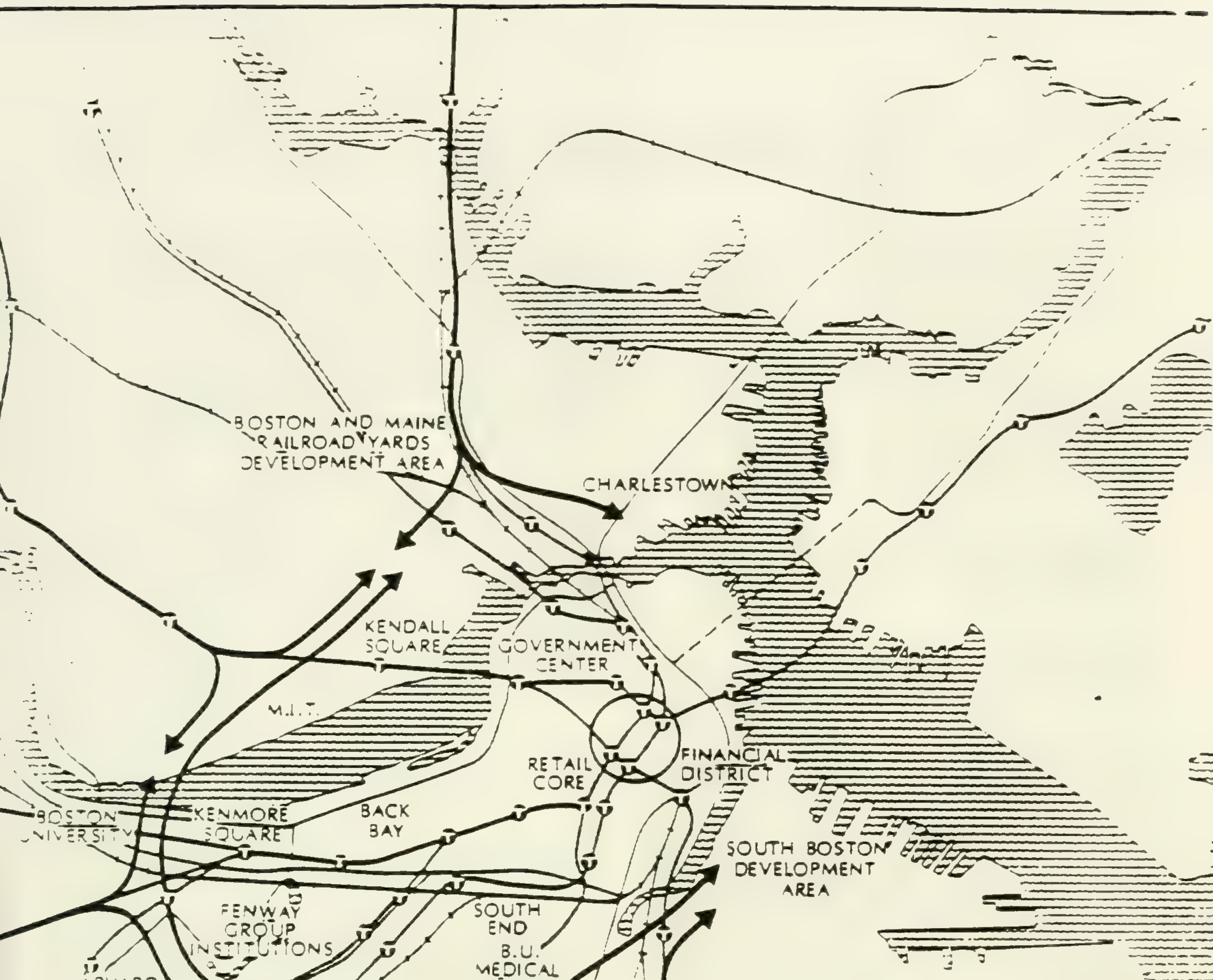
B. PREVIOUS STUDIES

This effort is not the first study of circumferential improvements. Two earlier area-wide transit studies provide a base of information from which the Circumferential Transit Feasibility Study has drawn.

Studies of circumferential transit service date to the Boston Transportation Planning Review (BTPR) of 1972. The BTPR study identified the primary corridor for service as the Grand Junction railroad right-of-way from the Technology Square area in Cambridge to Boston University, through the Fenway/Park Drive area, along Ruggles Street to an interface with the relocated Orange Line, on to Dudley Square in Roxbury, through the Boston City Hospital/B.U. Medical Center, crossing the Southeast Expressway and eventually terminating at South Station. In total, the corridor encompasses much of the area envisioned for what was then the recently abandoned Inner Belt Highway. The study included consideration of bus, light rail, heavy rail and personal rapid transit technologies (PRT). The accompanying Figure II-2 illustrates the concept contained in the 1972 BTPR.

In 1976, the Program for Mass Transit (PMT) again identified the former Inner Belt Highway corridor as the preferred location for the development of circumferential transit service. Both the 1977 and 1978 updates of the PMT continued the recommendations of transit system development in the Inner Belt Corridor.

These studies form the basis for much of the current planning effort, since a number of actions have been taken over the years to preserve right-of-way within the primary study area, including the Grand Junction railroad in Cambridge and the Inner Belt right-of-way incorporated into Ruggles Street and Melnea Cass Boulevard in Boston.



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE II−2

Circumferential Transit Concept Plan

Boston Transportation Planning Review (1972)

III. BACKGROUND

This chapter provides an overview of the planning process, key assumptions, and other background information useful in understanding the basis for the alternative actions described and evaluated in later chapters. In general, the study of circumferential corridor improvements required a regional, system wide approach, since the problems addressed and alternatives evaluated have broad ranging impacts on the entire MBTA system.

This chapter begins with an overall description of the planning process, followed by a summary of the public involvement program. The methodology for updating population and employment forecasts to the year 2010 is then discussed. This is followed by two sections which describe other related transportation projects and planning activities and the assumptions made with regard to other MBTA transit system improvements likely to be in place by the year 2010.

A. OVERVIEW OF PLANNING PROCESS

The Circumferential Transit Feasibility Study was designed to produce three categories of recommendations as follows:

- Long range, major corridor investments worthy of further study in an Alternatives Analysis/Draft Environmental Impact Statement process, but not likely to be operational for 15 to 20 years;
- Short range bus service improvements in the corridor that could be implemented in approximately the next five years, with a phasing strategy including immediate improvements; and
- Transportation System Management (TSM) improvements (generally, lower cost traffic and circulation actions) to assist bus operations in this very congested corridor, and capable of being implemented in the next ten years.

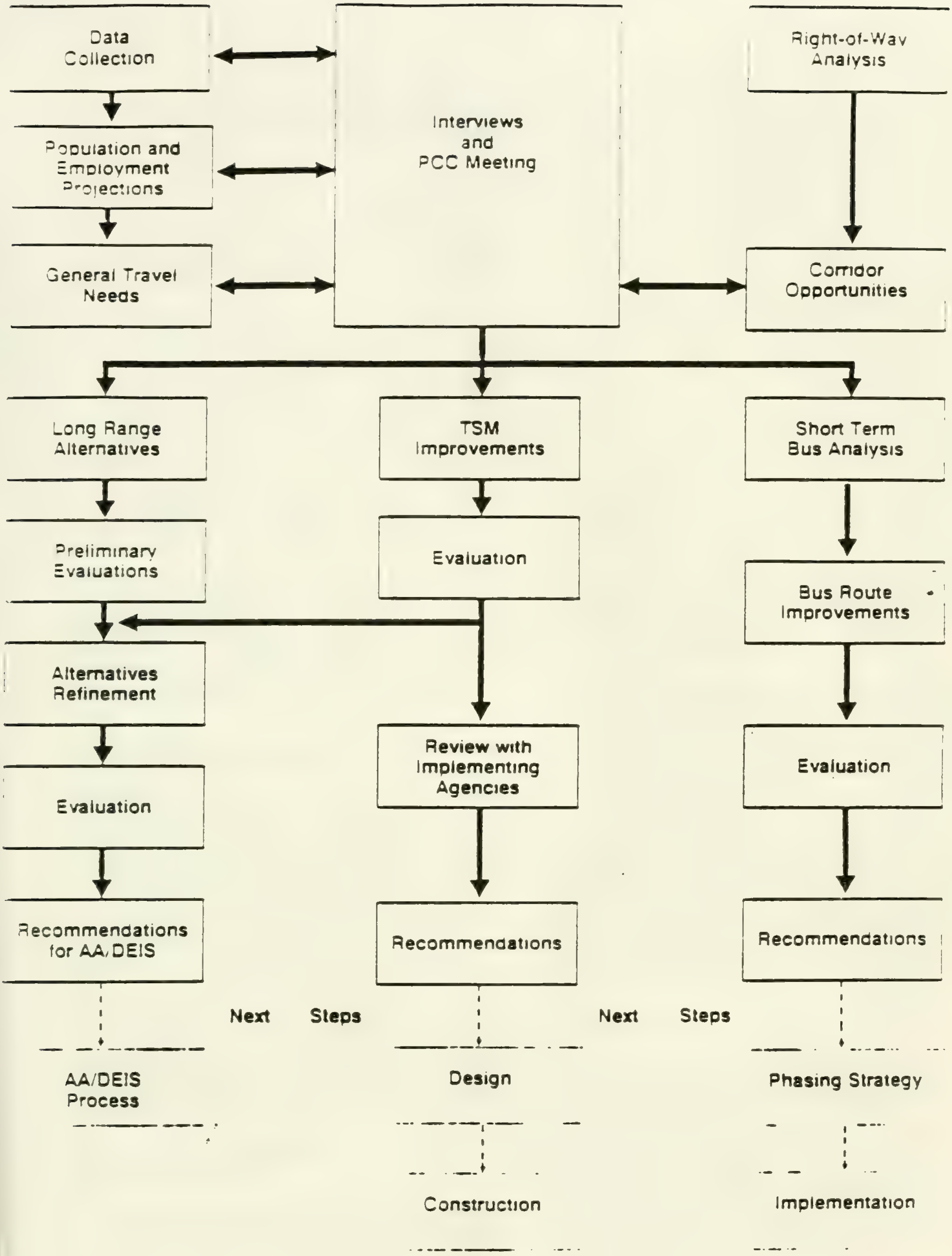
The overall planning process is illustrated in the accompanying flow chart of Figure III-1. The process started with four independent but related activities. These activities included the following:

- Data collection to update population and employment forecasts to the year 2010 which subsequently became the basis for travel forecasting;
- A series of interviews with local area officials, regional planning agencies, transportation providers, and major employers and institutions in the corridor to identify current transportation concerns, anticipated future problems, and long range plans;
- An analysis of right-of-way opportunities in the circumferential corridor based on information developed in earlier studies and limited new field work; and
- An analysis of existing travel conditions in the corridor, including the performance of both the street/highway and transit networks.

Next a sketch plan level analysis was undertaken to identify future travel needs and specific transit corridor opportunities. This was followed by the generation of long range alternatives, short range bus service improvements, and short to medium range TSM improvements. Alternatives in each category were then separately evaluated using various criteria. In the case of the long range alternatives both a year 2010 Baseline, or "No Action" option and a TSM alternative were included to provide a basis for comparing the cost effectiveness of the major capital investment options. The TSM alternative included in the long range analysis was constructed from the most promising short range bus service improvements combined with the most promising of the short to medium range traffic and roadway improvements.

The findings of these three evaluation steps form the basis for the separate recommendations made in each category. Upon completion of the review process of this report the following steps will occur:

- If decisions are made to proceed with the most promising of the long range alternatives the MBTA may approach the federal Urban Mass Transit Administration with a request to enter into an Alternatives Analysis/Draft Environmental Impact Statement process. Assuming a major investment becomes the preferred alternative(s) at the conclusion of this step, then preliminary engineering and a Final



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE III-1
Planning Process

Environmental Impact Statement would follow. This would be followed by actual system design and finally construction of the chosen improvement.

- If decisions are made to proceed with one or more of the short term bus service improvements, these would likely be phased as part of the MBTA's normal service planning and implementation process.
- If decisions are made to proceed with one or more of the TSM improvements, actions will vary with the nature of the improvement and the schedule established by the responsible implementing agency. The simpler traffic improvements involving restriping of streets or curb use restrictions might happen in a one to two year time frame, while the more extensive improvements involving intersection reconstruction or Massachusetts Turnpike ramp changes will require additional study and take longer to implement.

The first phase steps of the planning process, together with a summary of the public involvement process are discussed in greater detail in the balance of this chapter. Later chapters provide detailed information and findings regarding the alternatives generation and evaluation steps.

B. PUBLIC INVOLVEMENT

The level of public involvement in systems planning sets the tone for the entire planning, design and construction process. The MBTA made a decision at the outset that a program designed to generate extensive early involvement among regional, municipal, institutional, community entities and individuals was appropriate. This program has contributed substantively to the study by developing a network of study participants and by establishing mechanisms for productive communication among those involved. Contributions to the study included review and comment on project materials, discovery of additional information, guidance and refinement of study products and creation of an awareness and understanding of the project in the study area.

The network of participants in the study has included the following:

- Municipal department professionals, officials and representatives from the cities of Boston, Brookline, Newton, Watertown, Cambridge, Medford, Malden, Somerville, Everett, Chelsea, Revere, and Winthrop;
- Professionals from state and regional agencies including the Massachusetts Department of Public Works (MDPW), Massachusetts Executive Office of Transportation and Construction (EOTC), MassPort, the Metropolitan District Commission (MDC), the Metropolitan Area Planning Council (MAPC), the Joint Regional Transportation Committee (JRTC), and Caravan.
- Representatives from the major institutions and major employers in the corridor, including the John F. Kennedy Library, the Massachusetts State Archives, the University of Massachusetts/Boston, Bayside Exposition Center, South End Technology Square Associates, Tufts New England Medical Center, New England Baptist Hospital, Roxbury Community College, Boston Fenway Program, Northeastern University, Museum of Fine Arts, New England Conservatory of Music, Massachusetts Mental Health Center, Wentworth Institute of Technology, Massachusetts College of Pharmacy, Medical Area Service Corporation (MASCO), Boston College, Boston University, Harvard University, Massachusetts Institute of Technology (MIT) and Bunker Hill Community College; and
- A core group of thirty to forty interested citizens who participated as individuals or as representatives of neighborhood groups in the Project Coordinating Committee meetings and in individual meetings with study team members.

The public involvement process included three basic mechanisms which were conducted over the approximate two year planning process. These included mailings to a list of organizations and individuals, five Project Coordinating Committee (PCC) meetings; and over fifty individual meetings with public agencies, institutions, organizations and individuals.

1. Mailings

An early step in the planning process was to establish a mailing list. The initial list was developed based upon participants in other local and regional planning activities, municipal officials and professionals from the affected cities and towns, state and regional agency professionals, major institutions, transportation interest groups and known active organizations in the impacted corridor. The primary function of the mailing list was to reach out to local and regional officials and citizens interested in transportation issues. This initial list was updated throughout the planning

process in response to project inquiries, participation in the PCC meetings, and interest expressed at meetings held with the various cities, towns, agencies, institutions and organizations

During the course of the study six mailings were made. An initial mailing describing the study scope, objectives, and process was made in early 1987. This was followed by periodic mailings associated with each of the five PCC meetings held during the planning effort. These five mailings included detailed summaries of the information generated to date, and afforded study participants the opportunity to review presentation materials prior to the PCC meeting. This effort proved extremely productive and facilitated information flow and public feedback at the PCC meetings.

2. Small Group Meetings

Meetings with organizations and individuals were conducted throughout the planning process. In total over fifty meetings were conducted with government agencies, key institutions and organizations. This process began in early 1987 with approximately thirty initial information meetings. It was followed by subsequent meetings to review specific pieces of information or gain feedback on particular issues. Most active of the groups in the process were the Boston Transportation Department, the Boston Redevelopment Authority, the EOTC, the City of Cambridge Community Development Department, and the Medical Area Service Corporation (MASCO).

In addition to these meetings, the MBTA established a Technical Advisory Committee (TAC), consisting of representatives of the affected MBTA departments and professionals from the state and municipal agencies within the primary study corridor. The function of the TAC was the detailed examination of project materials and progress. TAC review and comment guided and refined the project work and products. The TAC met six times during the study process and was presented with essentially the same information later presented to the general public at the PCC meeting.

Throughout the planning process these small group meetings shaped the direction of work, provided invaluable guidance and generated many valuable and insightful ideas and concepts.

3. Project Coordinating Committee (PCC) Meetings

The Project Coordinating Committee (PCC) process was the mechanism for broadest public participation. In total five PCC meetings were held throughout the planning process. All individuals on the mailing list were notified of meetings approximately two weeks in advance, and were provided summaries of the information to be presented. All meetings were held on weekday evenings in the State Transportation Building. Attendance generally averaged between 50 and 75 individuals.

The dates and general topics of the five meetings were as follows:

- **Meeting #1 (7/22/87)** - topics covered included an overview of the planning process, scope and schedule; historical perspective; 2010 population, employment and travel forecasts; a description of possible corridor service concepts; a description of candidate corridors; a description of alternative transit technologies; and a description of conceptual short range bus improvements.

- **Meeting #2 (10/27/87)** - topics covered included detailed information on alternative short term bus improvements, a detailed description of the six initial long range alternatives, and a discussion of the evaluation criteria to be used in assessing alternative actions.

- **Meeting #3 (8/2/88)** - topics covered included the preliminary findings of the analysis of long range alternatives and recommendations on modified alternatives for the final analysis, the preliminary results of the ridership forecasts for the long range alternatives, a detailed description of the TSM alternative, and the scope for the analysis of short term bus service improvements.

- **Meeting #4 (3/9/89)** - topics covered included the recommended short term bus service improvements; the preliminary recommendations for TSM improvements in the portion of the corridor between Ruggles Station on the Orange Line and the crossing of the Charles River; and the right-of-way, land use, environmental, ridership and capital cost information for the long range alternatives

- **Meeting #5** (8/15/89) - topics covered included the findings of the cost effectiveness analysis and the preliminary study recommendations

The Project Coordinating Committee process strengthened the framework and substance of communications within the regional transportation planning process. PCC meeting discussions generated a genuine give and take of ideas and information among meeting participants. New potential alternatives were identified and options were refined under the scrutiny on the PCC meetings.

C. POPULATION AND EMPLOYMENT FORECASTS

Population and employment estimates for the base year of 1985 and forecasts to the year 2010 were developed by the study team in association with CTPS. The circumferential corridor defined for analysis purposes included twelve communities within a five mile radius of Park Street Station. Within the circumferential corridor the ring of neighborhoods and communities surrounding Boston Proper were analyzed at the traffic zone level. Boston Proper and the communities outside the corridor, but within the study area, were also analyzed in terms of overall population and employment trends. Figure III-2 illustrates how these areas were structured. As part of the travel forecasting process trips from outside the study area, to and through the corridor, were generated and included in the analysis based on demographic forecasts prepared by CTPS.

1. Methodology

Year 1975 and 1980 figures prepared by the Metropolitan Area Planning Council (MAPC) were used as the basis for the forecasts. Table III-1 identifies the communities and the corresponding zones included in the analysis. Preliminary review of the 1980 forecasts by the study team, CTPS and the cities of Boston and Cambridge indicated some discrepancies in zone level employment figures which were caused by the model's allocation formulas. These were corrected by CTPS to provide an accurate 1980 base listing by zone.

To reach year 2010 forecasts two more steps were undertaken. First the 1980 numbers were updated to the base year of 1985 by adjusting for known developments completed or pending in each traffic zone. Then the figures were updated to the year 2010 at five year increments. Mid-term projections were made based on information obtained from the appropriate communities to determine known development projects. Long term projections were based on an inventory of vacant or underutilized land parcels and an analysis of historical growth trends, adjusted for the stated attitudes of local officials toward new development.

TABLE III-1

Communities and Zones Included in Circumferential Transit Study Area

Community	MDPW Zone Numbers
Central Boston (Boston Proper)	1-60
Circumferential Corridor:	
Remainder of Boston	61-193
Chelsea	194-199
Cambridge	200-229
Somerville	230-244
Brookline	245-256
Everett	290-296
Remainder of Study Area:	
Winthrop	257-261
Revere	262-269
Medford	270-280
Malden	281-289
Watertown	341-344
Newton	345-360
Remainder of Region	all other zones

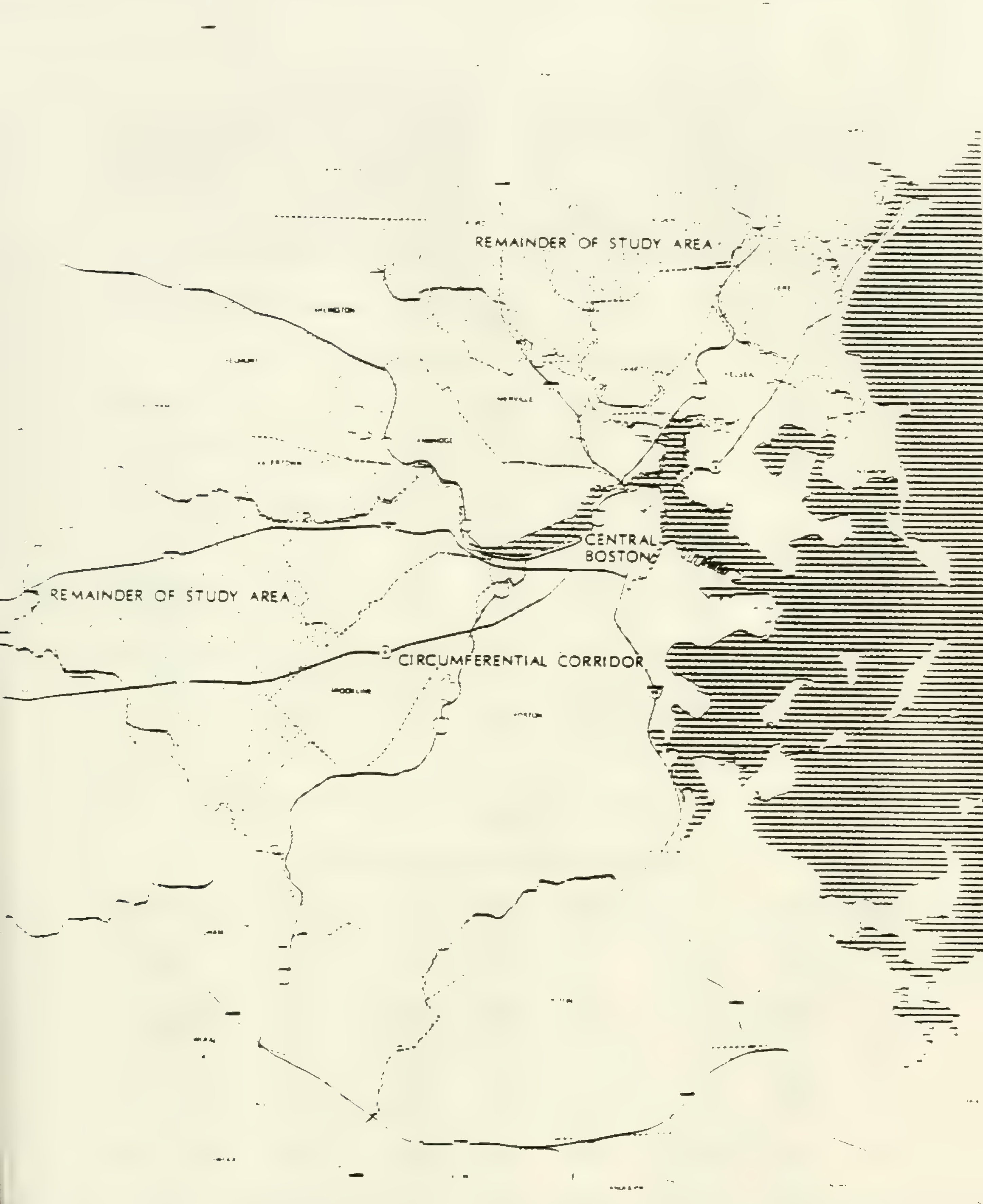


FIGURE III-2
Communities Included In Study Area Forecasts

At the outset of the Circumferential Transit study MAPC had already completed 1980-85 updates and 2010 forecasts for Boston, Brookline, Cambridge and Medford zones within the study area. Thus, the study team needed only to complete the update of the 1980-85 data for the remaining study area communities (Chelsea, Everett, Malden, Revere, Somerville, and Winthrop). Once the 1985 updates were finalized, MAPC staff then extended the projections to 2010. The totals then were cross checked with a second set of projections calculated using estimates of future labor force participation and commuting to the study area from outside the region. The resulting numbers were sent to the communities for review and comment and revised accordingly. The final 1985 and 2010 population and employment forecasts for the study area are summarized in Tables III-2 and III-3.

TABLE III-2

Study Area Population, 1975, 1985 and 2010

MDPW Zone	1975	1985	Change	% Change	2010	Change	%Change
Central Boston	63.295	75.671	12.376	19 6%	72 013	-3 658	-4 8%
% Study Area	3 6%	4 8%	-7 7%		4 7%	9 2%	
% Region	1 7%	2.0%	-17 4%		1 9%	-2 8%	
Circum. Corridor	1 378.250	1.220 397	-157 853	-11 5%	1 188.938	-31 458	-2 6%
% Study Area	79 0%	77 1%	97 8%		77 0%	79 4%	
% Region	36.2%	32.7%	222 1%		30 8%	-24 4%	
Total Outer Ring	303.474	287 539	-15 935	-5 3%	283.056	-4 484	-1 6%
% Study Area	17 4%	18.2%	9 9%		18.3%	11.3%	
% Region	8 0%	7 7%	22 4%		7 3%	-3.5%	
Total Study Area	1.745.019	1.583.607	-161 412	-9.2%	1.544 006	-39.601	-2.5%
% Region	3 805.651	3.734.563	-71 088	-1.9%	3.863.318	128.755	3 4%
Total Region	3.805.651	3.734.563	-71 088	-1 9%	3.863.318	128.755	3 4%

TABLE III-3

Study Area Employment, 1975, 1985 and 2010

MDPW Zone	1975	1985	Change	% Change	2010	Change	%Change
Central Boston	289 440	315.935	26 495	9.2%	408.353	92.418	29 3%
% Study Area	32.0%	30.1%	18 3%		30.6%	32.2%	
% Region	18.1%	15.5%	6 1%		16.2%	18 7%	
Circum. Corridor	517 494	618.059	100 565	19 4%	791.029	172.969	28 0%
% Study Area	57.2%	58.9%	69 6%	121 6%	59 2%	60 2%	102 1%
% Region	32.4%	30.4%	23.2%	71.7%	31 3%	35 1%	115 3%
Total Outer Ring	97 369	114.859	17 490	18 0%	136 878	22.019	19 2%
% Study Area	10.8%	11 0%	12.1%		10.2%	7 7%	
% Region	6 1%	5 6%	4 0%		5 4%	4 5%	
Total Study Area	904 303	1 048 853	144 550	16 0%	1 336.259	287 406	27 4%
% Region	56 5%	51 6%	33 3%		52 9%	58 2%	
Total Region	3.805.651	3.734.563	-71 088	-1 9%	3 863.318	128 755	3 4%

2. Development Trends

The 1975 and 1985 data and the 2010 forecasts indicate that study area communities and neighborhoods will continue to experience declines in population and increases in employment similar to those projected for the region as a whole.

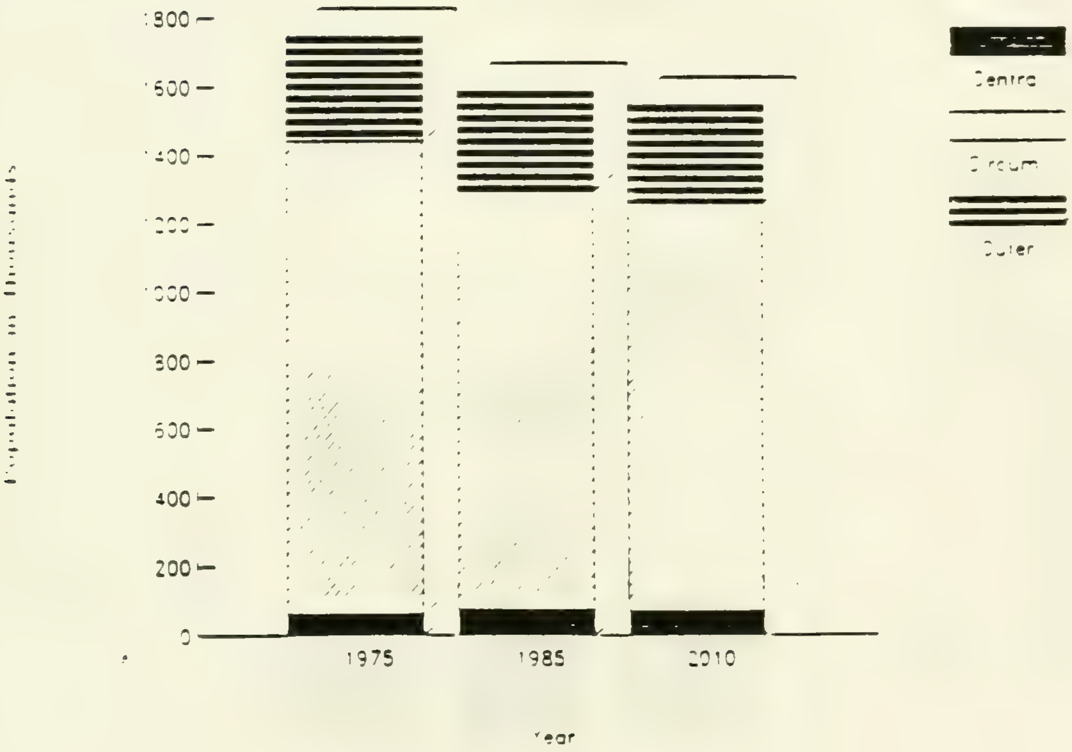
Key findings with regard to trends in population are illustrated in Figure III-3 and include the following:

- Within the entire study area the circumferential corridor accounts for about 75% of total population; Boston Proper contains only about 5%, and the outer communities account for the remaining 20%.
- Population in both the circumferential corridor and entire study area declined 11.5% between 1975 and 1985. In Boston Proper population increased by almost 20% from 1975 to 1985, reflecting new downtown housing development and the revitalization of downtown neighborhoods.
- Between 1985 and 2010, study area population is forecast to continue to decline, although at a slower rate than from 1975 to 1985.

FIGURE III-3

Circumferential Corridor

Population: 1975, 1985, 2010



Key findings with regard to employment trends are illustrated in Figure III-4 and include the following:

- Employment in the circumferential corridor is and will continue to be greater than employment in Boston Proper. While Boston Proper employment of 289,000 represents about 32% of study area employment in 1985, the circumferential corridor, with employment of 618,000, accounts for 57%. By the year 2010, Boston Proper decreases to 31% of study area employment and the circumferential corridor increases to 59% of study area employment. Between 1985 and 2010, the circumferential corridor will gain 108,600 employees, while Boston Proper will gain 92,400 employees.

- Circumferential corridor employment represents about 30% of employment in the entire MAPC region both in 1985 and 2010. Boston Proper represents about 20% of regional employment.

The analysis also indicated that development in key activity centers outside Boston Proper but within the circumferential corridor is expected to intensify greatly by the year 2010. The study team identified a number of activity centers with significant growth potential, including Logan Airport, the Charlestown Navy Yard, the Lechmere/East Cambridge/North Point areas, the Kendall Square area, the MIT/University Park area, the Longwood Medical area, the Southwest corridor area, and the South Boston Piers area. Forecast population and employment change for these areas are presented in Tables III-4 and III-5. Key findings of this work include:

- Population in the key corridor activity centers will decline slightly from 1985 to 2010 but at a lower rate than the study area as a whole.

- Employment in key corridor activity centers will increase by 66.6%, adding 62,680 employees to the circumferential corridor. This increase

FIGURE III-4

Circumferential Corridor

Employment: 1975, 1985, 2010

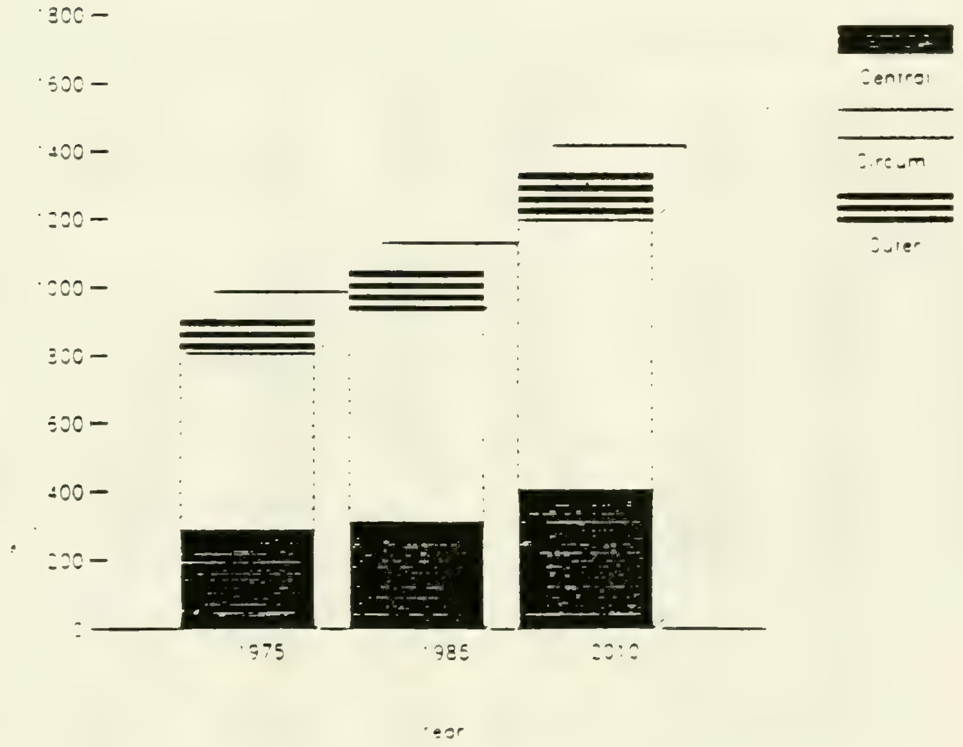


TABLE III-4

Population for Key Activity Centers, 1975, 1985 and 2010

MDPW Zone	1975	1985	Change	% Change	2010	Change	% Change
Total Boston Core	63 295	75 671	12.376	19 6%	72.013	-3 658	-4 8%
% Study Area	3 6%	4 8%	-7 7%		4 7%	9 2%	
% Region	1 7%	2 0%	-17 4%		1 9%	-2 8%	
Activity Centers							
Navy Yard	1 449	1.751	302	20 8%	3.355	1 604	91 6%
South Boston Piers	958	1 653	695	72.6%	1.573	-80	-4 8%
Boston University	10 036	7.973	-2.063	-20 6%	7.588	-385	-4 8%
LMA	7.653	7.801	148	1.9%	7 424	-377	-4 8%
LMA	4.965	4 808	-157	-3.2%	4.575	-232	-4 8%
U-Mass	4.612	1 447	-3.165	-68.6%	1.377	-70	-4 8%
Logan Airport	0	0	0		0	0	
Lechmere	1 932	1.742	-190	-9 8%	1 662	-80	-4 6%
E Cambridge	2.309	1.850	-459	-19.9%	1.765	-85	-4 6%
Kendall	2.697	1 920	-777	-28.8%	1.832	-88	-4 6%
Kendall	5.698	6.228	530	9 3%	5.942	-286	-4 6%
Kendall	2.986	2.486	-500	-16.8%	2.372	-114	-4 6%
Total Activity Centers	45 295	39 658	-5 637	-12 4%	39 465	-194	-0 5%
% Study Area	2 6%	2.5%	3 5%		2.6%	0 5%	19 5%
% Region	1.2%	1 1%	7 9%		1 0%	-0.2%	-14 2%
Total Study Area	1.745.019	1.583.607	-161 412	-9.2%	1.544.006	-39.601	-2.5%
% Region	45.9%	42.4%	227 1%		40 0%	-30.8%	
TOTAL REGION	3 805.651	3.734.563	-71.088	-1.9%	3.863.318	128.755	3 4%

TABLE III-5

Employment for Key Activity Centers, 1975, 1985 and 2010

MDPW Zone	1975	1985	Change	% Change	2010	Change	% Change
Total Boston Core	289.440	315.935	26 495	9.2%	408.353	92.418	29 3%
% Study Area	32.0%	30.1%	18.3%		30 6%	32.2%	
% Region	18.1%	15.5%	6.1%		16.2%	18 7%	
Activity Centers							
Navy Yard	3.895	2.262	-1.633	-41 9%	12.106	9.844	435 2%
South Boston Piers	5.507	8.405	2.898	52.6%	33.750	25.345	301 5%
Boston University	6.251	7.484	1.233	19 7%	8.036	552	7 4%
LMA	11.456	4.979	-6 477	-56.5%	5.347	368	7 4%
LMA	1.662	22.562	20.900	1.257.5%	26.101	3.539	15 7%
U-Mass	894	1.276	382	42.7%	1.370	94	7 4%
Logan Airport	10.000	12.329	2.329	23.3%	12.482	153	1 2%
Lechmere	5.000	5.334	334	6.7%	9.924	4 590	86 1%
E. Cambridge	5.000	3.659	-1.341	-26.8%	4.659	1.000	27 3%
Kendall	3.620	3.378	-242	-6.7%	11.638	8.260	244 5%
Kendall	19.906	20.759	853	4 3%	29.527	8 768	42 2%
Kendall	4.000	1.722	-2.278	-57 0%	1 889	168	9 7%
Total Activity Centers	77 191	94 149	16 958	22.0%	156 830	62 680	66 6%
% Study Area	8.5%	9 0%	11 7%		11 7%	21 8%	
% Region	4 8%	4 6%	3.9%		6.2%	12.7%	
Total Study Area	904.303	1.048.853	144 550	16 0%	1.336.259	287 406	27 3%
% Region	56.5%	51 6%	33 3%		52.9%	58.2%	
TOTAL REGION	1 599.573	2.033.087	433.514	27 1%	2.526.545	493 458	24 3%

represents over 20% of the study area increase and 13% of the employment growth in the entire region between 1985 and the year 2010.

- Several zones show particularly large increases in employment between 1985 and 2010, as follows:

  South Boston Piers - 25,300
  Kendall Square - 18,000
  Charlestown Navy Yard - 9,800
  Lechmere area - 4,600
  Longwood Medical Area - 3,500

D. RELATED TRANSPORTATION AND DEVELOPMENT PROJECTS

This section provides summary information on related public transit and transportation studies and projects, as well as major redevelopment activities, and discusses potential implications for the Circumferential Transit Feasibility Study.

Within the primary study area (a 5-mile radius from downtown Boston) many transportation and major land development projects are in the planning, design, and/or construction phases. Many of these activities such as the South Boston Piers/Fort Point Channel Transit Study could have significant implications for circumferential transit development. Others such as the reconstruction of North Station are less critical and will have secondary consequences only.

The following sections provide brief discussions of the related studies and projects grouped by transit projects, highway projects and major land redevelopment activities.

1. Transit Projects

A number of transit projects have been recently completed, are under design or are in the planning stages by the MBTA. Many of these projects could have significant impacts on the future development of circumferential transit service. The accompanying map in Figure III-5 shows the general project locations in relationship to the circumferential corridor as identified by previous studies.

For each transit project it was necessary to make certain specific assumptions regarding the status of capital improvements and service additions/changes for the year 2010 forecasting work.

a. **Southwest Corridor/Orange Line** - has been relocated from the Washington Street elevated alignment to the Penn Central right-of-way (Southwest Corridor) below grade. Both rapid transit and commuter rail services operate in the corridor. The new Orange Line intersects the proposed circumferential alignment at Ruggles Station. Ruggles Station has been viewed as one of the most important transfer points and possibly an initial terminus for circumferential service. For purposes of the year 2010 forecasting work, all currently planned Orange Line and commuter rail improvements were assumed to be in place including six-car trains on the Orange Line.

b. **Bowdoin/Charles Connector** - would link the Red and Blue Lines by extending Blue Line service under Cambridge Street from Bowdoin to Charles Stations. At present these are the only rapid transit lines that do not intersect. There would be no physical interface between this project and a circumferential transit line. For purposes of year 2010 forecasting, this connection was assumed to be in place.

c. **South Boston Piers/Fort Point Channel Study** - a number of transit options are under study to serve the South Boston Piers area across the Fort Point Channel. These options include people mover, light rail, trolley bus, conventional bus, and rapid rail technologies, on a variety of alignments below and at grade. None of the options under study would connect directly with the circumferential corridor. If, however a circumferential alignment along Albany Street through South Bay, to South Station were chosen a potential interface at South Station might be possible. An additional consideration is technology. If a people mover system were developed in the South Boston Piers area, the same technology might be logical for eventual implementation in the circumferential corridor. For purposes of year 2010 ridership forecasting, the Red Line loop option from Broadway Station along the Seaport Access Road then to South Station was assumed to be in place.

d. **Blue Line Modifications** - designs are being developed for modernization and platform lengthening to accommodate six car trains on the Blue Line. The Blue Line currently operates with four-car trains during peak hours. By the year 2010 it was assumed that the Blue Line will operate with six-car trains.

e. **Red Line Pocket Track** - establishment of a turnback facility for the Red Line north of Kendall Square is being considered by the MBTA. The

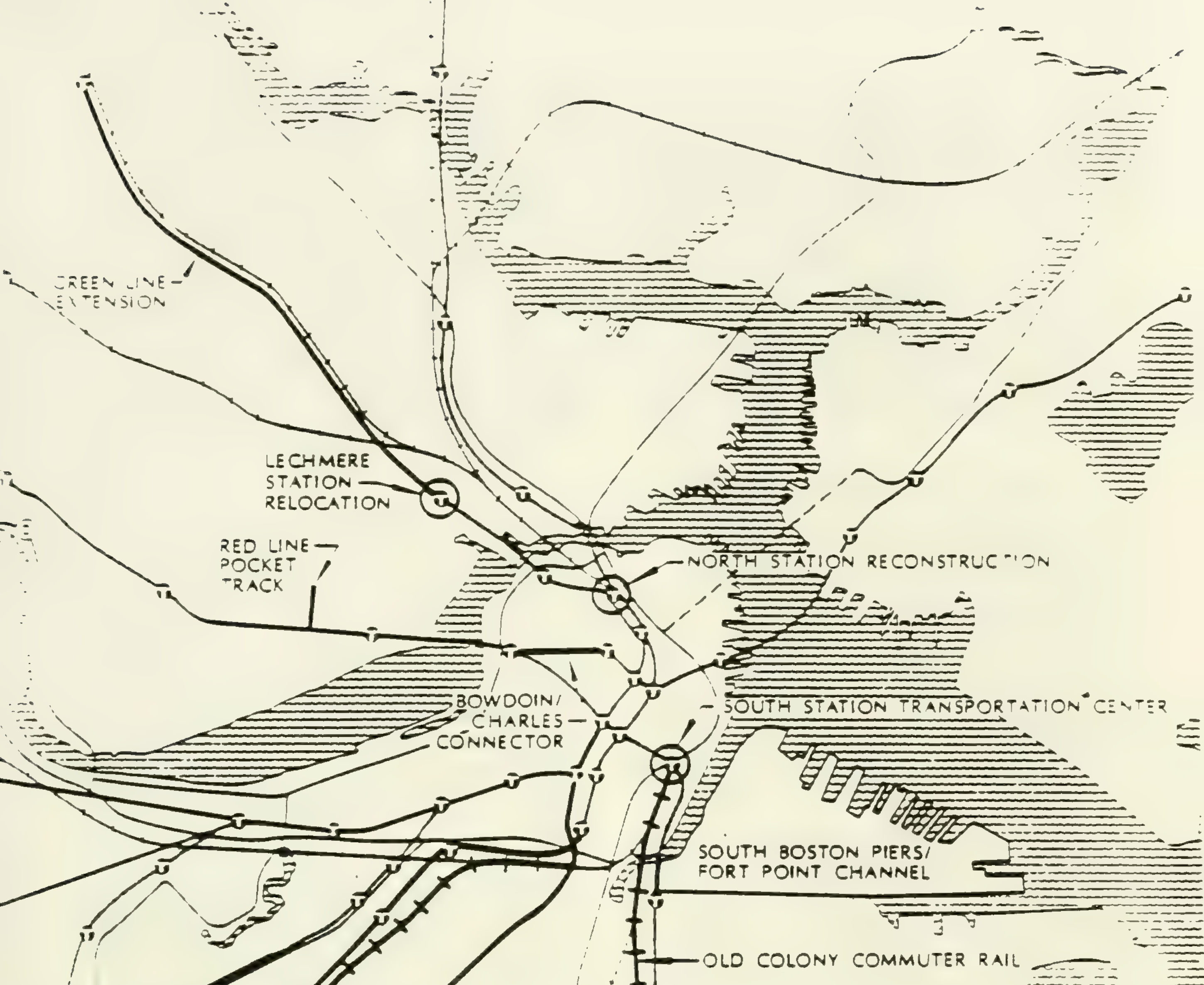

GREEN LINE EXTENSION
LECHMERE STATION RELOCATION
RED LINE POCKET TRACK
NORTH STATION RECONSTRUCTION
BOWDOIN/ CHARLES CONNECTOR
SOUTH STATION TRANSPORTATION CENTER
SOUTH BOSTON PIERS/ FORT POINT CHANNEL
OLD COLONY COMMUTER RAIL
ARBORWAY
REPLACEMENT TRANSIT/ IMPROVEMENT
SOUTHWEST CORRIDOR/ ORANGE LINE

FIGURE III-5
Related Transit Improvements

proposal would involve the construction of a pocket track under the Grand Junction railroad line north of Main Street in Cambridge. This facility would allow a portion of the Braintree and Ashmont trains to be turned back before reaching Central Square and is estimated to result in significant savings in fleet size and operating costs. The development of the pocket track would limit some alignment options for those circumferential alternatives contemplated to operate in subway below the Grand Junction railroad north of Main Street. It would also make the development of a new Red Line station, between Kendall and Central, difficult. The right-of-way analysis for all circumferential alternatives assumed the development of this facility.

f. **Replacement Transit/Improvement Study** - a Draft Environmental Impact Report (DEIR) is currently being prepared which evaluates bus, trackless trolley, and light rail service as replacement options in the Washington Street corridor, in place of the now dismantled elevated Orange Line. All replacement service alternatives would cross the circumferential corridor. As in the case of the Orange Line/Circumferential interface, the convenience of the transfer between lines is important. For purposes of the year 2010 forecasting, light rail service was assumed from Dudley Square (Roxbury) to the Green Line central subway.

g. **Arborway Study** - bus and light rail alternatives are being considered as permanent service options between Brigham Circle and Forest hills. Green Line light rail service will continue to be operated on the section of the line between Park Street and Brigham Circle. A bus/light rail transfer will be required if bus service is implemented on the outer section of the route. The segment of the circumferential corridor along Huntington Avenue could coincide with an Arborway segment. If a single right-of-way is shared, coordination of operations would be necessary. For purposes of year 2010 forecasting, restoration of light rail service to Forest Hills was assumed.

h. **Green Line Accessibility Study** - is examining the feasibility of various accessibility improvements for the elderly and handicapped on the MBTA's Green Line. All aspects of Green Line access will be examined including station entrances, platform design, and vehicle boarding and alighting. High platform operation on the Green Line, if chosen as a preferred alternative, would need to be accommodated at any interface with the circumferential service. All accessibility improvements to the Green Line were assumed applicable to the circumferential light rail options.

i. **Green Line Alternatives Beyond Lechmere** ten options have been evaluated for improving transit service between Lechmere Station on the Green Line and points in Somerville. These options include several alternative Green Line extensions, exclusive busways, and changes in bus operations. A new circumferential line would intersect with a radial extension of the Green Line at or beyond Lechmere Station. Coordination is necessary to provide for the compatibility of this interface and convenience of transfer between the two lines. For purposes of year 2010 forecasting, extension of the Green Line from Lechmere to Ball Square was assumed.

j. **Relocation of Lechmere Station** - an Environmental Impact Report (EIR) which analyzes the relocation of Lechmere Station to the east side of the O'Brien Highway is being prepared. The new station would be combined with an enlarged light rail maintenance facility and allow for the extension of Green Line service to the north. Relocation of the Lechmere Station would facilitate the interface with all circumferential alternatives under consideration. The design of the new station should include provision for possible future interface with the circumferential line. For analysis purposes, all circumferential alternatives assumed the relocation of Lechmere Station.

k. **Green Line Three Car Train Operation** - power and track improvements are currently underway along the Green Line to provide the necessary infrastructure to operate three car trains throughout the system. For purposes of the circumferential analysis, the B, C, and D Lines as well as the proposed G Line (Ball Square) were assumed capable of operating with three car trains in the year 2010.

l. **Watertown Trolley** - the MBTA is evaluating proposals to restore trolley service on the A Line of the Green Line light rail system. A restored A Line would cross the probable circumferential alignment in the Fenway area. For purposes of year 2010 forecasting, restoration of light rail service was assumed not to occur.

m. **South Station Transportation Center** - a major renovation which involves rehabilitation of its physical structure, redesign of commuter rail terminal facilities, and construction of a bus terminal, air rights commercial development, and parking garage. The circumferential corridor as now envisioned would not extend to South Station. If, however, an alternate southern routing along Albany Street through South Bay to South Station were chosen, then provision at South Station for the circumferential service would be needed. Because

the primary circumferential corridor would not extend to South Station, no assumptions were necessary about the facilities' reconstruction.

n. **North Station Reconstruction** - will involve relocation of the Green Line Station underground and construction of a parking garage. The reconstructed station will provide improved connections between the Green/Orange Lines and commuter rail. The primary northern circumferential termini do not include North Station. If, however, circumferential service were extended from Lechmere to North Station, provision for the corridor would be necessary. Because the primary circumferential corridor would not extend to North Station, no assumptions were made about the facility's reconstruction.

o. **Old Colony Commuter Rail** - service may be restored to the South Shore on the Greenbush, Middleborough and Plymouth lines. The lines would extend initially from Braintree Station to Scituate, Plymouth and Bridgewater. Eventually service would be extended all the way to South Station. The Old Colony Commuter rail line would pass through the JFK/U-Mass Station on the Red Line. If a connection were provided here to the potential southern terminus of the circumferential corridor, a significant interchange might occur, especially for travellers headed to/from the Longwood and Southwest corridor areas. For purposes of year 2010 forecasting, restoration of all three lines to South Station was assumed. Transfers between the Old Colony line and circumferential service were assumed possible at the JFK/U-Mass Station, for those circumferential alternatives extending this far south.

p. **Commuter Rail Extensions** - are under study by the MBTA in the following corridors:

- Newburyport from Ipswich,
- Worcester from Framingham,
- I-495/Bellingham from Needham, and
- Fall River/New Bedford from Stoughton.

All of these extensions, except Newburyport, would terminate at South Station and have little impact on the circumferential alternatives under study. None of these were included in the year 2010 ridership analysis.

q. **Commuter Boat Operations** - currently operating in Boston Harbor include the following:

- Rowes Wharf to Logan Airport.
- Hingham to Rowes Wharf
- Hull to downtown Boston
- Charlestown Navy Yard to Long Wharf

A number of other services are under study or are being considered. Passenger boat operations were assumed to have little or no impact on the circumferential corridor. For purposes of year 2010 forecasting, South Shore, cross-harbor airport and Charlestown Navy Yard services were assumed to be expanded.

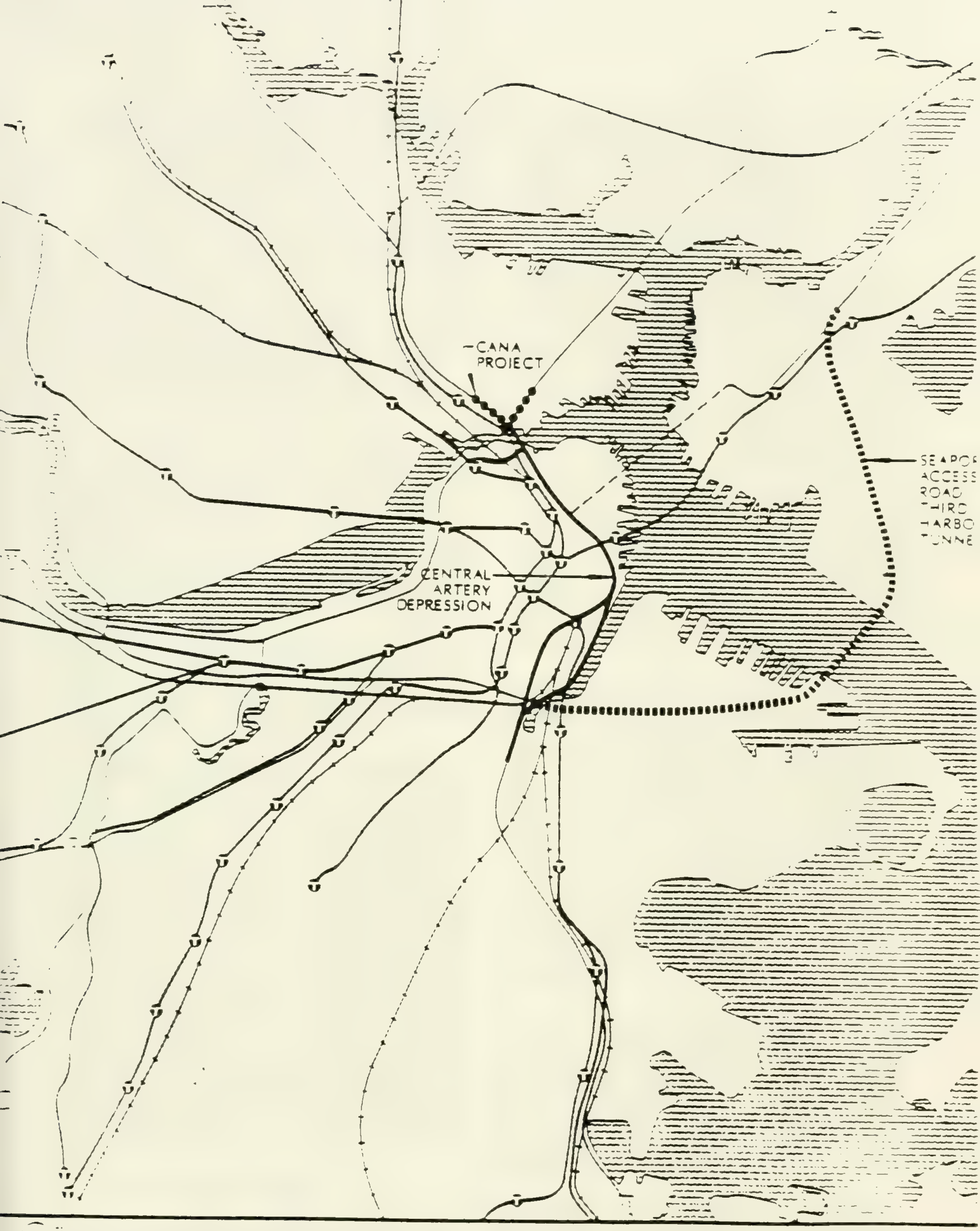
r. **Park and Ride Program** - the MBTA is designing and constructing new parking facilities at various commuter rail and transit stations. This includes expansion of existing parking facilities as well as new lots and structures. The modelling of the year 2010 transit network for the circumferential alternatives assumed park and ride capacity sufficient to meet modelled demand will be available system wide.

s. **Bus Corridor Studies** - of operations and demand for additional services throughout the region are complete or underway for the North Shore, North, Central North, Northwest, West, Southwest, South, and South Shore. The studies vary with respect to their relevancy to circumferential transit. The highest number of existing circumferential bus routes or route segments are in the in the Southwest and Central North corridors. In the Southwest corridor, many of these routes act as collectors for the Orange Line. In the Central North corridor, there are several routes serving circumferential segments that are based at Central and Kendall Squares in Cambridge, Allston/Brighton, and Sullivan Square in Charlestown. The Central North corridor study cites the lack of crosstown bus service and the level of auto travel between Cambridge (Harvard Square) and Somerville as issues that should be addressed. Service in the Southwest and Central North corridors could become part of a coordinated circumferential bus system. Alternatively, circumferential service incorporating a different technology (e.g., heavy rail, light rail, guided bus) could replace some existing bus routes. For purposes of year 2010 forecasting, bus routes were modified to reflect the most logical changes to serve the corridor, depending on the alternative analyzed.

2. Highway Projects

Three major highway projects are in the planning, design and or construction phase within the study area. These projects are illustrated in Figure III-6 and discussed in the following sections.

a. **Central Artery/Third Harbor Tunnel** - I-93 in downtown Boston will be reconstructed underground with increased vehicle-carrying capacity, and a four-lane tunnel and Seaport



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE III–6
Related Highway Improvements

Access Road will be constructed connecting the I-90/I-93 South Cove Interchange to Logan Airport. The access road/tunnel component of the project is scheduled for completion in 1996; the Central Artery will require several additional years of construction. A cross-harbor extension of circumferential service could occur via bus service through the new tunnel. The Seaport Access Road will incorporate HOV lanes, which could be a link in the circumferential system. The possible reconstruction of the South Bay interchange could provide opportunities for preferential treatment of transit vehicles in the general area. All year 2010 circumferential alternatives assumed completion of this project and the provision of a system of express bus routes through the new Third Harbor Tunnel.

b. Central Artery North Area (CANA) Project - involves reconstruction of the interchange of I-93 and Route 1 in Charlestown. Ramp connections will change and elevated sections in Charlestown's City Square will be depressed underground. Surface intersections in City Square will be reconstructed. Construction is underway, and project completion is scheduled for 1994. The reconstruction of City Square will present a number of opportunities for improved bus services in that portion of circumferential corridor between the Charlestown Navy Yard, Community College Station on the Orange Line, and Lechmere Station on the Green Line. All year 2010 circumferential alternatives assumed completion of this project.

c. Cross Harbor and Regional Transportation (CHART) Study - is an analysis of the Third Harbor Tunnel alignment and related transportation infrastructure, for the purpose of identifying potential design improvements that could facilitate travel to/from Logan Airport. Reconfiguration of circulation at the airport also is under study, with specific emphasis on a system that would include a central terminal or processor of all passengers. The CHART study has implications for any potential interface of circumferential service at Logan Airport. Impacted are both express bus services in the new Third Harbor Tunnel and connections between the Blue Line or the East Boston leg of the circumferential corridor through Everett and Chelsea. All circumferential alternatives assumed that a direct transit connection is provided from both the Blue Line and any East Boston circumferential extension to the new Central Processor at Logan Airport.

3. Major Development Projects

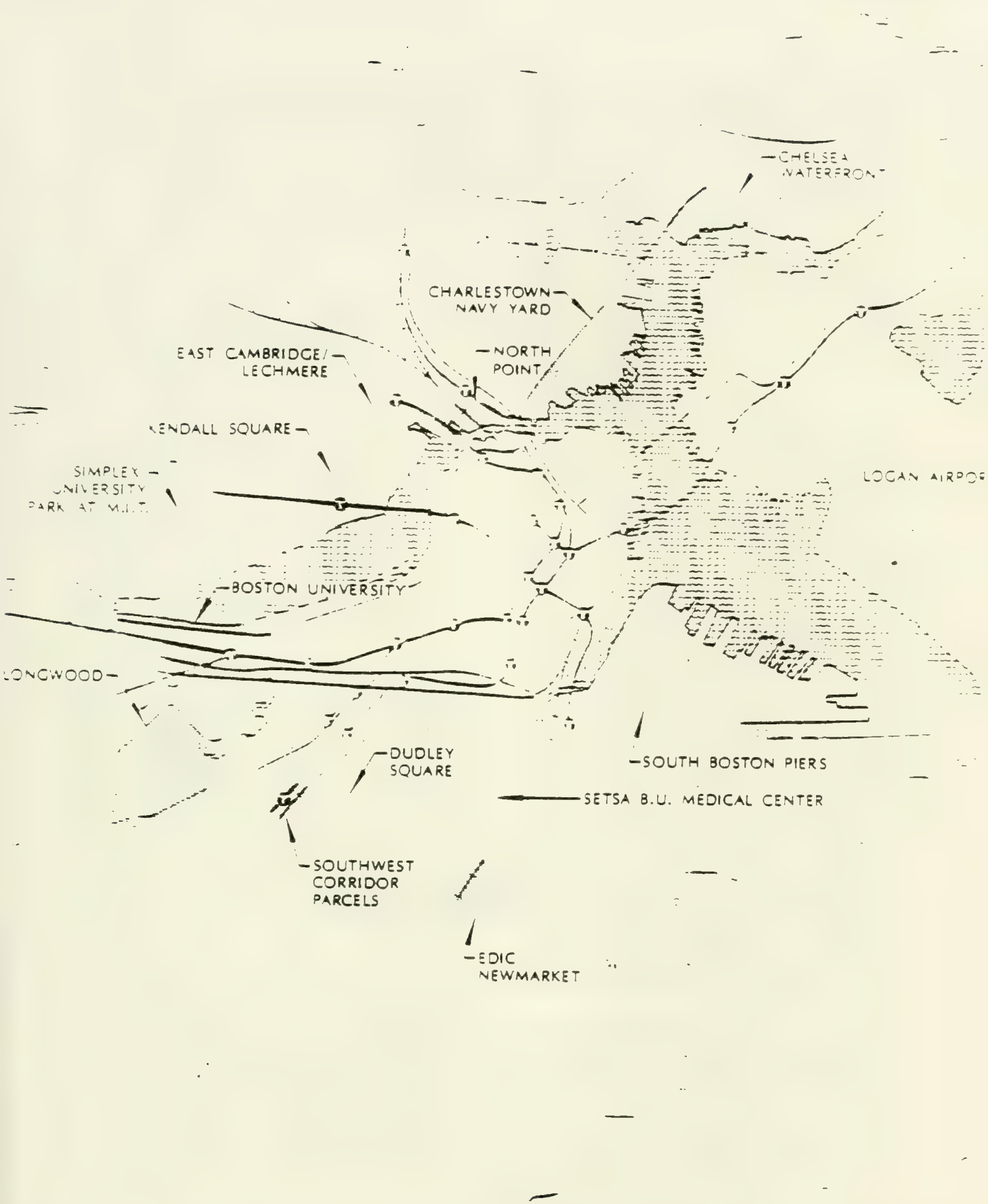
Current and projected development activities in areas outside the Boston downtown core are major determinants of the need for transit service in the circumferential corridor. To identify the nature, scale and status of major projects, interviews were conducted with public agencies, institutions and developers. The following sections summarize the current status of development activities in each of the major areas. Figure III-7 illustrates the general locations of these areas.

a. SETSA/Boston University Medical Area - this area in Boston's South End includes the Boston University Hospital, Boston University Medical School, Boston University School of Graduate Dentistry, Boston City Hospital, and the Solomon Carter Fuller Mental Health Center. These institutions employ 8,000 and attract a daytime population of 10,000, including staff, students, visitors, and outpatients. A major proposal for the area is the South End Technology Square mixed use complex on a 19-acre, city-owned redevelopment parcel east of Albany Street. The developer, University Associates, proposes 350,000 square feet of office space, a 242 room hotel, a 180 seat restaurant and 16,000 square feet of retail space in two phases. The Master Plan process underway by institutions in the area is seeking to develop an areawide policy regarding desired circumferential corridor and Orange Line replacement service options.

b. EDIC Newmarket - the City of Boston's Economic Development and Industrial Commission (EDIC) has undertaken a master planning effort for the Newmarket Industrial District to the south of the South End Medical Area described above. The five year plan is designed to preserve 2,000 jobs and create another 2,000 jobs. Two key sites are the Sears property to the east of Massachusetts Avenue, which is slated for acquisition and redevelopment to create 1,000 jobs, and Parcel 3 southwest of Massachusetts Avenue. This area would be rebuilt to create new development parcels. In the northern portion of the Newmarket area, the proposed replacement for the Suffolk County House of Correction will house 823 beds on a 7.5 acre site.

c. South Boston Piers - large-scale mixed use projects have been proposed for a number of sites in the South Boston Piers area, including the Fan Pier/Pier 4 areas, World Trade Center, and McCourt properties. In addition, the City of Boston has both land use and traffic studies underway to develop new zoning and urban design guidelines as well as strategies for a new street grid.

d. Dudley Square Redevelopment - is the subject of a Boston Redevelopment Authority plan which calls for construction of a total of 1500 - 2000 housing units. BRA plans for this area had once



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE III-7
Related Area Development Activities

called for large scale commercial development however these have been greatly reduced due to community concerns about the type and density of the proposed land uses. The main implications for the circumferential alternatives are that the Dudley area is not likely to become a major attractor of trips as it would have been with the prior plan. Rather the neighborhood will generate increased numbers of home-based residential trips.

e. **Southwest Corridor/Parcel 18** - is a 5.6 acre development parcel, located adjacent to Ruggles Station. As part of a Parcel-to-Parcel linkage plan, in association with redevelopment of the Kingston-Bedford Garage parcel in downtown Boston, a developer has been designated by the BRA for a project consisting of up to 800,000 square feet of office space, 51,200 square feet of retail space, a 90,000 square foot cultural center, and 150-200 housing units. In addition, 145 dwelling units are planned for BRA Parcel 16, and a new Roxbury Community College campus is planned just to the south of the site on Columbus Avenue. This project contributes to the heavy transit trip generation projected for Ruggles Station. Introduction of circumferential service will improve access to this parcel, particularly in terms of employment opportunities for Boston residents.

f. **Longwood Medical Area** - the medical and educational institutions in this area employ close to 20,000 and are a major generator of employee, student and visitor trips. Approved institutional development plans, according to MASCO, the umbrella organization providing coordinated planning and other services for its members in the area, will add up to 358,000 square feet of office, hotel and retail space by 1992. This development will add 2000 work trips and 2000 non-work trips per day to the Longwood area. This area is one of the highest trip generators in the circumferential corridor. Relatively poorly served by transit today, the institutions in this area have long pressed for service improvements.

g. **Simplex/University Park** - is a mixed use project occupying 33 acres in the Cambridgeport section of Cambridge, west of Massachusetts Avenue, between Central Square and the Charles River. Included in the project are 1.9 million square feet of office space, 400 dwelling units, and a 250-300 room hotel. In addition, MIT plans to add 1.5 million square feet of space at its east campus. While close to Central Square on the Red Line, improved crosstown transit access is desirable to serve this major activity center.

h. **Kendall Square** - commercial development in Cambridge Center (the neighborhood surrounding Kendall Station on the Red Line) has grown rapidly over the past few years as part of Cambridge's redevelopment plan. Since 1981 2.7 million square feet of office and research & development space has been built here along with 40,000 square feet of retail space and a 431 room hotel. Redevelopment is largely complete, as is the new street pattern. A 127,000 square foot office building is planned as of 1988. The newly built office space, some of which is still being leased in 1988, is attracting a large work force to this area, making it a major regional activity center. Similar to Cambridgeport, Red Line access is good, but crosstown transit needs improvement.

i. **East Cambridge/Lechmere/North Point** - the area surrounding Lechmere Station has been another growth area for the City of Cambridge, capitalizing on its proximity to downtown Boston and the Charles River. Since 1980, 2.6 million square feet of office/research & development-space has been built here, along with 44,000 square feet of retail space, 145 housing units, and a 200 room hotel. In the planning and development stages as of 1988 are an additional 485,000 square feet of office and research & development space, 695,000 square feet of retail space and 753 housing units. A recent development in the "North Point Residence Office and Business District" area southeast of Lechmere Station is "North Point Center", located on the 4-acre Federal Distillers Building site. Formerly slated for a 438,000 square foot office project, the site is now to be developed with 435 rental housing units and 200 hotel rooms. The new zoning designation in the North Point area is for a low density base, with a PUD overlay, allowing higher density to a maximum of 1.5 million square feet of commercial space. The recently constructed and committed future development in this area has greatly increased transit needs, especially since traffic impacts are of great concern to surrounding residential neighbors. Crosstown links to Kendall Square on the west, and to Charlestown on the east are important.

j. **Charlestown Navy Yard** - this Boston Redevelopment Authority urban renewal area has undergone dramatic change over the past ten years as housing and commercial uses have replaced the former U.S. Navy facility. A total of 1.2 million square feet of office space and 1200 housing units have been built or are under development, with an additional 400,000 square feet of office space and 600 additional housing units planned. In addition, the New England Aquarium recently announced plans to study the feasibility of relocating to the

Charlestown Navy Yard. Should this occur, as many as 2,000,000 visitors a year could be added to Navy Yard activity by the 1994 design year. While close to downtown Boston, the Navy Yard is poorly served by existing rapid transit and bus lines. Water shuttles and private shuttle buses have been put into service to help improve downtown access. Circumferential corridor improvements could significantly improve access between the Navy Yard and key radial transit lines.

k. **Chelsea Waterfront** - the City of Chelsea has experienced considerable change over the past 15 years, with projects such as the Admiral's Hill residential development and the industrial park west of the Tobin Bridge. To the east of Route 1, however, large tracts of prime waterfront land with excellent access to Logan Airport remain underutilized. The Chelsea Redevelopment Authority has initiated a master planning effort for this area, and is seeking to designate a portion of the area along the Chelsea and Mill Creeks as an urban renewal area. Potential land uses include residential, hotel, or airport related industrial uses. In the long term, the nature and extent of new land uses in the waterfront area will affect trip generation in this circumferential route segment.

l. **Logan Airport** - employs 14,920 on a daily basis, and attracts 33,341 total daily passenger and employee round trips, is a major generator within the circumferential corridor. In 1988, transit accounts for only 6.4 percent of total passenger and employee trips. By 2010, total employment is projected to increase by 75 percent, and total enplanements by 88 percent. Future airport plans call for increasing airside capacity while attempting to reduce auto traffic through parking management, improved transit, and other strategies. Transit service through the planned Third Harbor Crossing is of great interest to Logan's planners. A direct transit link to Logan is assumed as part of the 2010 base transit network, as is express bus service through the new Third Harbor Tunnel. Access from the north, especially Chelsea, Everett, and Malden is addressed by circumferential options.

E. YEAR 2010 MBTA SYSTEM

In the development and analysis of circumferential alternatives it was necessary to make a number of assumptions regarding improvements that would occur elsewhere in the MBTA system by the year 2010. These assumptions were most critical as they impacted the ridership forecasts and operating cost estimates. At the time these decisions were made in 1987, many questions regarding projects such as the Roxbury Replacement service and the South Boston Piers Transit Study were unresolved. Thus, a best guess given the limited information at the time was made. In some instances projects such as the Red Line Loop appeared to be the preferred option in 1987, and are now not likely to be pursued. The most significant changes compared to today include the following

- **Red Line** - all station platform lengthening is assumed to be complete and both lines are assumed to operate with six car trains. The South Boston Piers loop between Broadway Station and South Station is assumed to be completed, with one additional station serving the piers area.

- **Orange Line** - all station platform lengthening is assumed to be complete and the line is assumed to operate with six car trains in the peak periods

- **Green Line B, C & D Branches** - power upgrading will allow all three of these branches to accommodate up to three car trains

- **Green Line E Branch** - service is restored to Forest Hills on the Arborway. Power upgrading will allow operation of up to two car trains all the way to Forest Hills.

- **Green Line F Branch** - service between Dudley Square in Roxbury and North Station is assumed to operate in the Washington Street corridor

- **Green Line G Branch** - service between Ball Square in Somerville and Blanford Street on the B Line is assumed to operate.

- **Blue Line** - all station platform lengthening is assumed to be complete and the line is assumed to operate with six car trains in the peak periods.

- **Old Colony Commuter Rail** - all three branches are assumed operational between the South Shore and South Station

- **Commuter Rail Stations** - for purposes of the year 2010 analysis, access between the commuter rail lines and the circumferential corridor was assumed possible wherever the two systems intersect. Thus, depending on the circumferential alternative access was assumed possible at JFK/U-Mass, Ruggles, near Boston University on the Framingham Line, Community College and Sullivan Square,

- **Express Bus** - services to Logan Airport from the South Shore west and South Station are assumed to operate through the new Third Harbor Tunnel

- **Local Bus Network** - depending on the circumferential alternative under study various modifications were made in the network of existing bus routes serving the corridor

- **Park and Ride System** - for the purposes of forecasting system ridership potential it was assumed that the supply of park and ride spaces was expanded to meet forecast 2010 demand.

IV. CIRCUMFERENTIAL TRANSPORTATION

This chapter summarizes the findings of the analysis of existing and forecast future travel patterns and conditions in the circumferential corridor. Included are summaries of both the pattern and volume of trip making among and to and from activity centers in the corridor, an assessment of the existing transportation system within the corridor, and a description of the conceptual services that were the basis for identifying the short and long range alternatives discussed and evaluated in later chapters.

The overall approach to the analysis of travel patterns was to build on the activity center population and employment work summarized in Chapter III. The first step was a sketch plan level assessment of the relative magnitude of travel in the corridor based on trip table information supplied by CTPS. This was followed by an analysis of alternative linkages within the area to define general corridors. Finally, the ability of the existing transportation system, emphasizing transit, to serve these forecast travel patterns was analyzed.

A. CIRCUMFERENTIAL TRAVEL PATTERNS

The estimates of existing (1985) and future (2010) population and employment, described in Chapter III were the basis for assessing both current travel demand in the circumferential corridor and that likely to occur by the design year. Travel demands in both cases were assessed based on the trip tables developed by CTPS through application of the regional transportation models. Travel demand in the corridor can be categorized as either having both an origin and destination within one of the corridor activity centers or as having one trip end in the corridor and one outside the corridor. Trips with one end in the corridor and the other end elsewhere in the region represent over 60 percent of total corridor travel demand. Trips with both beginning and end points in the corridor account for slightly less than 40 percent of total cooridor demand.

1. Existing Travel Demand (1985)

An analysis of the 1985 CTPS trip table for all zones within both the primary and secondary study areas formed the basis for identifying current travel demand, as well as transit service deficiencies for the short term bus improvements described in Chapter V. This process involved aggregating all zones into 74 districts and then analyzing those zone interchanges which exceeded a threshold level of 750 trips per day. Factors examined in the analysis included population and employment density in the zones and the current mode split to transit for work trips.

The results of this analysis are summarized in Table IV-1 which identifies those zones (by the name of the primary activity center) with the highest potential interchanges within the study area. Figure IV-1 shows the general location of these zones by activity center.

2. Future Travel Demand (2010)

The year 2010 analysis was performed in a similar fashion to the analysis of current travel demand, except emphasis was placed on identifying trips that might be served by a major transit link within the entire primary travel corridor. This corridor which had been analyzed in previous studies, would connect zones 1 through 24 illustrated in Figure IV-2.

The first step in the process was to summarize both the magnitude and density of population employment, and trip ends in each study zone for the design year. The results of this analysis are summarized in Table IV-2.

The next step was to identify trip interchanges for each zone by those totally within the study area (circumferential trips) or those having one trip end in the corridor and one trip end outside the corridor (radial/circumferential trips). Once this was complete it was then possible to estimate total travel in the generalized corridor connecting the study zones. Circumferential trips were loaded directly on the appropriate sketch network segment serving the connecting zones. Radial/circumferential trips were loaded on the circumferential network based on the appropriate existing radial connections between the study area zone and the external zone of origin or destination. The resulting estimate of year 2010 travel volumes by corridor segment are illustrated in Figure IV-3.

TABLE IV-1
1985 Circumferential Travel Patterns

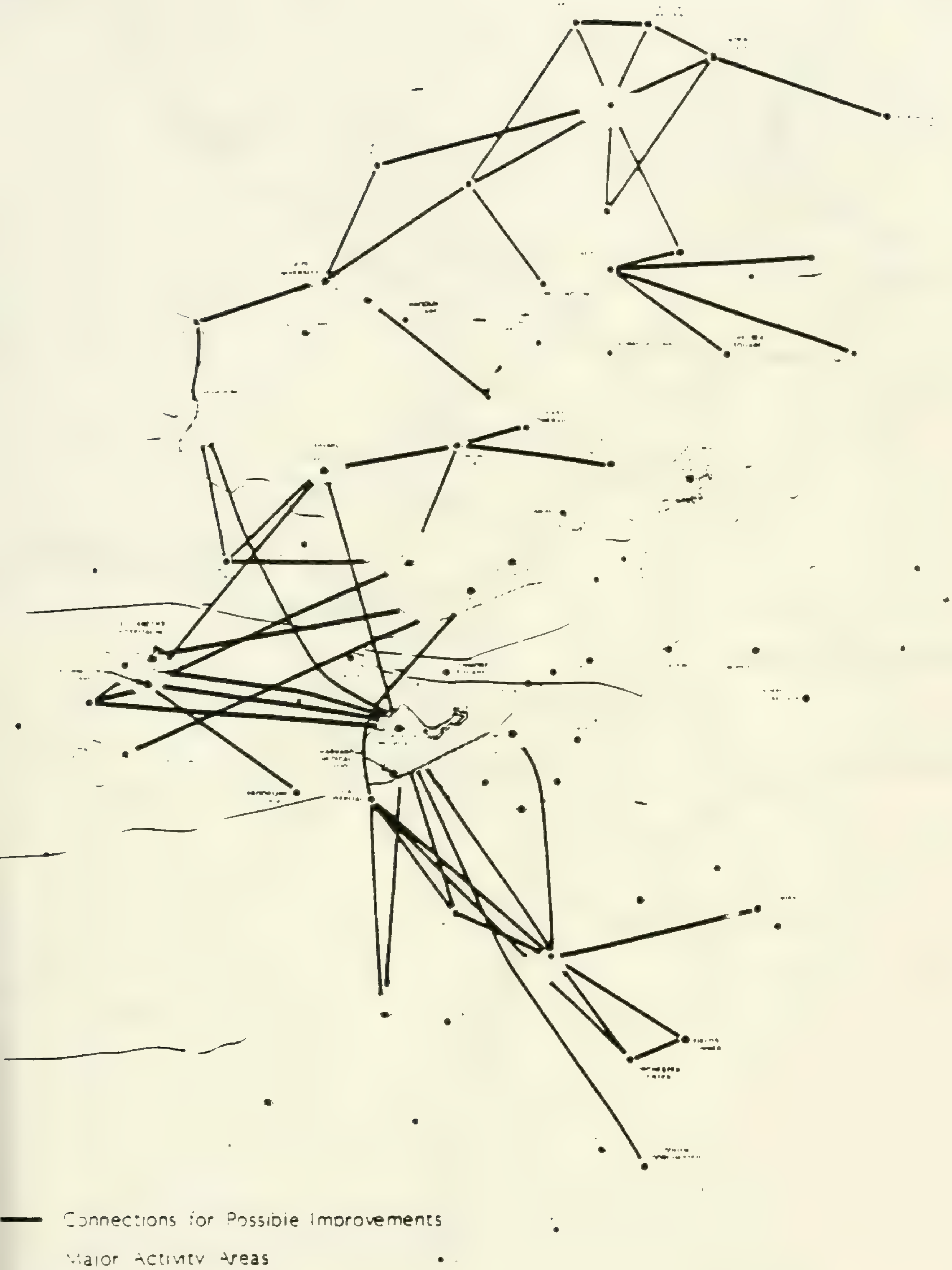
Activity Center Interchange	1985 Total Daily Trips	1980 Work Trip % By Transit
MALDEN SQUARE		
and Oak Grove	1734	9
and Medford Square	916	28
and Medford	839	6
and South Malden	1356	23
and North Malden	1042	14
and Everett Square	1002	27
and Linden Square	807	29
TOTAL	7695	18
LONGWOOD		
and Washington Square	1581	53
and Harvard Square	1265	60
and Forest Hills	952	33
and Dorchester Center	921	44
and South Roxbury	636	58
and Fresh Pond	582	22
and Brighton	547	51
and South Dorchester	501	34
and Brighton Center	485	35
TOTAL	7468	46
WASHINGTON SQUARE		
and MIT	1698	24
and Longwood Medical	1581	53
and Brookline Village	1407	20
and Harvard Square	819	37
and St. Elizabeth's	710	33
and Central Square	702	83
TOTAL	6916	38
VA HOSPITAL		
and MIT	733	51
and Grove Hall	1387	46
and Uphams Corner	1318	17
and Forest Hills	1201	43
and South Roxbury	896	26
and Dorchester Center	849	49
TOTAL	6383	38
WEST EVERETT		
and Waterfront Development	1791	0
and Everett Square	1563	8
and Revere	966	0
and Chelsea Square	712	13
TOTAL	5032	4

Activity Center Interchange	1985 Total Daily Trips	1980 Work Trip % By Transit
GROVE HALL		
and VA Hospital	1387	46
and South Roxbury	953	54
and Columbia Point	684	[illegible]
and Northeastern Univ	580	58
and Fields Corner	1318	15
TOTAL	4922	37
MIT		
and Washington Square	1698	24
and VA Hospital	733	51
and Brighton	726	31
and Cleveland Circle	708	44
and Brighton Center	474	49
TOTAL	4338	36
LINDEN SQUARE		
and South Malden	1245	25
and Malden Square	807	29
and Northgate Shopping Cntr	784	0
and North Malden	1283	0
TOTAL	4119	13
UNION SQUARE		
and Central Square	744	[illegible]
and Harvard Square	673	40
and Bunker Hill CC	630	6
and East Somerville	2011	6
TOTAL	4057	25
HARVARD SQUARE		
and Longwood Medical	1265	60
and North Brighton	1022	15
and Washington Square	819	37
and Union Square	673	40
TOTAL	3779	45
MEDFORD		
and Wellington Circle	924	[illegible]
and Tufts University	841	[illegible]
and Malden Square	839	[illegible]
and Oak Grove	729	[illegible]
TOTAL	3332	

TABLE IV-1 (continued)
1985 Circumferential Travel Patterns

Activity Center Interchange	1985 Total Daily Trips	1980 Work Trip % By Transit
NORTH BRIGHTON		
and Harvard Square	1022	35
and Central Square	787	62
and Fresh Pond	669	19
and Alewife	644	73
TOTAL	3121	46
OAK GROVE		
and Malden Square	1734	9
and North Malden	571	0
and Medford	729	0
TOTAL	3033	5
DORCHESTER CENTER		
and Longwood Medical	921	44
and VA Hospital	849	49
and Fields Corner	1159	36
TOTAL	2928	42
NORTH MALDEN		
and Linden Square	1283	0
and Malden Square	1042	14
and Oak Grove	571	0
TOTAL	2895	5
EAST SOMERVILLE		
and Union Square	2011	16
and Ball Square	732	0
TOTAL	2743	12
SOUTH MALDEN		
and Malden Square	1356	23
and Linden Square	1245	25
TOTAL	2601	24
EVERETT SQUARE		
and Malden Square	1002	27
and West Everett	1563	8
TOTAL	2565	16

Activity Center Interchange	1985 Total Daily Trips	1980 Work Trip % By Transit
SOUTH ROXBURY		
and VA Hospital	896	26
and Longwood Medical	636	58
and Grove Hall	953	54
TOTAL	2485	45
CENTRAL SQUARE		
and North Brighton	787	62
and Union Square	744	23
and Washington Square	702	83
TOTAL	2232	55
FRESH POND		
and Alewife	766	10
and North Brighton	669	19
and Longwood Medical	582	22
TOTAL	2016	17
ALEWIFE		
and North Brighton	644	73
and Fresh Pond	766	10
and Tufts University	485	7
TOTAL	1895	31
TUFTS UNIVERSITY		
and Medford	841	22
and Medford Square	509	0
and Alewife	485	7
TOTAL	1835	12
BRIGHTON		
and MIT	726	31
and St. Elizabeth's	551	22
and Longwood Medical	547	51
TOTAL	1824	34
MEDFORD SQUARE		
and Malden Square	916	28
and Tufts University	509	0
TOTAL	1425	18



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE IV-1
Activity Center Bus Connections

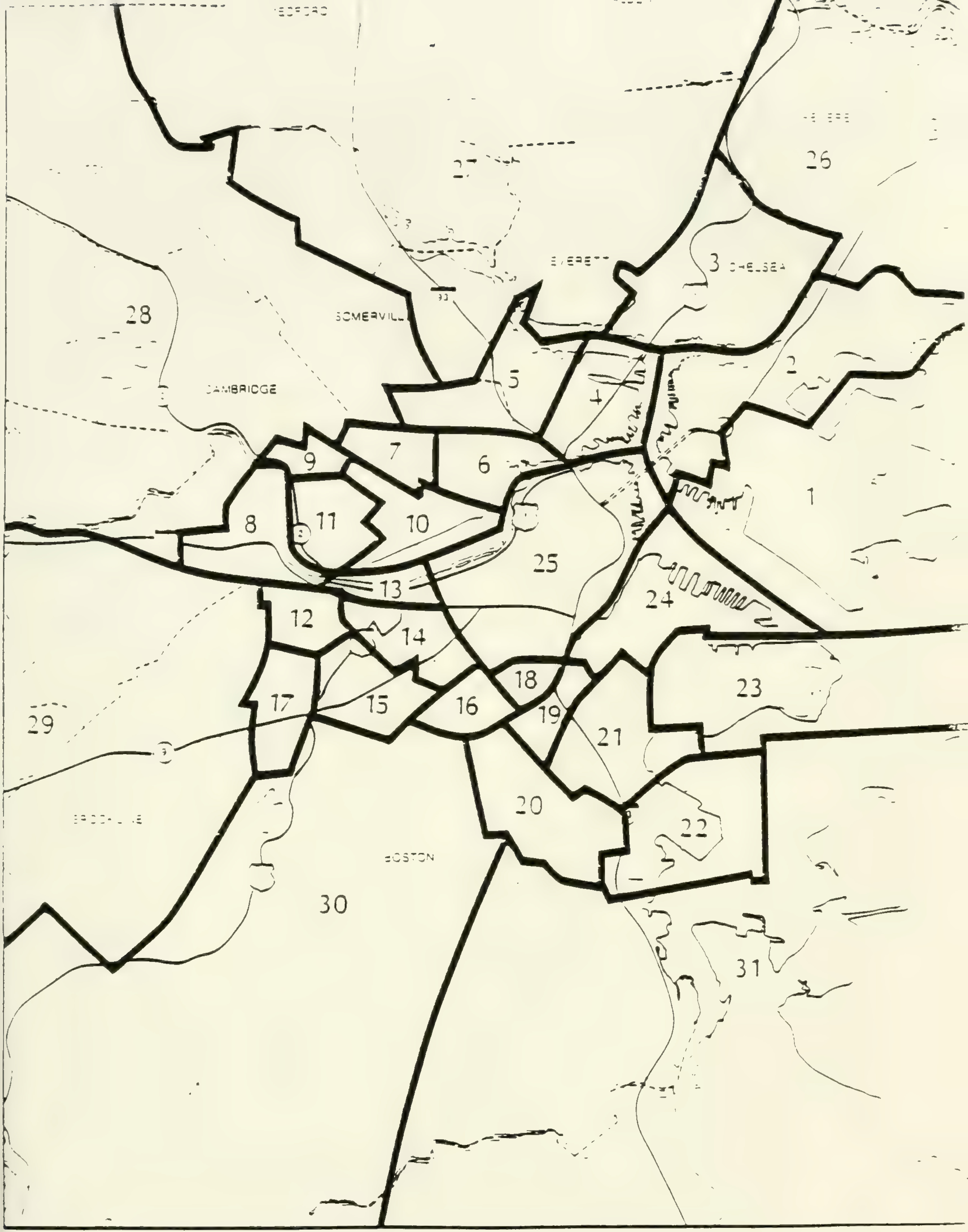


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FIGURE IV-2
Circumferential Sketch Plan Zones

trips. This decrease in rail trips suggests that the bus improvements provide travel time savings for some trips which are now made via the rail system. The bus route improvements may reduce the number of transfers at the downtown stations as riders shift from taking a radial rail line into downtown and transferring to another, to using an improved circumferential bus connection. With the bus route improvements, commuter rail trips increase and express bus trips decrease. These changes are relatively small, and will not significantly affect the operation of the transit system.

For the local bus category, the overall passengers per bus mile was calculated to show the relationship between the change in ridership and change in route miles. Under the final set of improvements the average passengers/bus-mile decreases slightly. The coverage ratio, which is the ratio of fare revenues to operating costs, remains unchanged. These figures indicate that as the ridership and revenue increase on the bus system the operating costs can be covered as effectively as in the current network.

VI. TRANSPORTATION SYSTEMS MANAGMENT IMPROVEMENTS

As part of the Circumferential Transit Feasibility Study an analysis of potential low cost traffic improvements was undertaken for the primary study corridor. The objective of this analysis was to identify improvements that would facilitate improved bus operations and smooth traffic flow in those areas of greatest congestion. The traffic improvements identified in this chapter, together with the short term bus service improvements discussed in Chapter V and the added express bus services detailed in Chapter VII, comprise the year 2010 Transportation Systems Management (TSM) Alternative used as the basis for analyzing the cost effectiveness of the long range alternatives.

A. CORRIDOR TRAFFIC IMPROVEMENTS

One of the early tasks in the study was to perform an analysis of traffic conditions with the objective of identifying low and moderate cost improvements for bus operations. The corridor was divided into segments, as illustrated in Figure VI-1, extending from Columbia Point to the Charlestown Navy Yard. Field observations were conducted in each segment and identified problems were reviewed with affected local jurisdictions. Where warranted general solutions to problems were then identified.

The following sections provide a summary of the findings of the segment by segment analysis.

1. Segment A: Columbia Road from JFK/U Mass Station to Edward Everett Square

No serious traffic problems exist at present along this portion of Columbia Road. Southeast of Edward Everett Square, Columbia Road has two travel lanes in each direction. Immediately beyond Edward Everett Square, there is one parking lane on Columbia Road which could be re-striped for a travel lane if needed. However, the parking conflicts seem to be minor, and this improvement would have only a small impact on traffic operations.

2. Segment B: Massachusetts Avenue from Edward Everett Square to Glynn Way

North of Edward Everett Square double parked vehicles and turning truck traffic occasionally congest traffic flow on Massachusetts Avenue. The existing parking could be taken for added travel capacity and smoother bus stop operations on this one mile segment. This will require restriping of the roadway and an enforcement program. Significant land use changes and traffic circulation changes are likely to occur in this area as a result of development plans now being formulated by the Boston EDIC. The MBTA should review these changes as they develop to assure smooth transit operations in the area. Potential bus travel time reductions on the order of ten percent might be possible in this area.

3. Segment C: Massachusetts Avenue from Glynn Way to Melnea Cass Boulevard

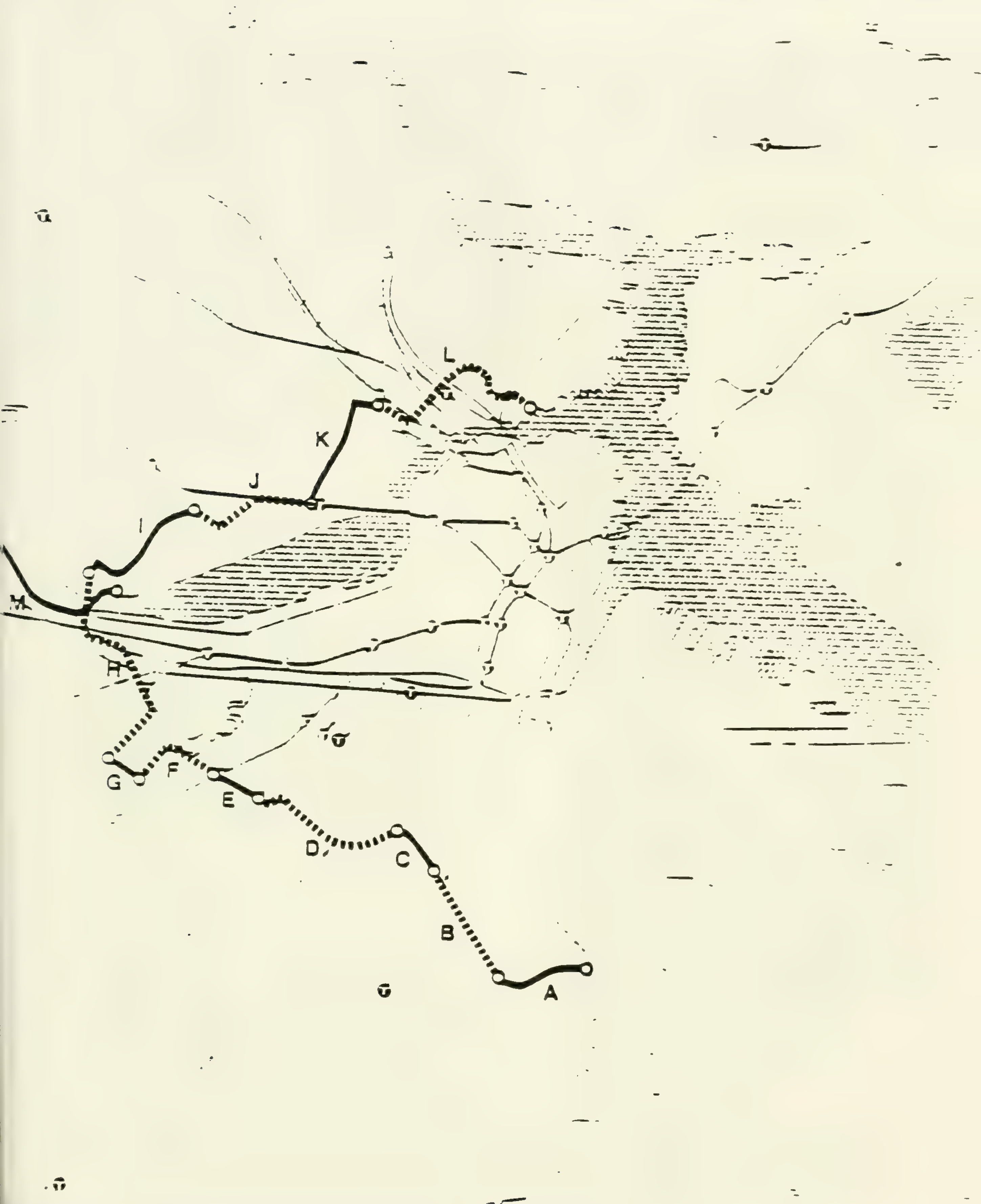
The intersection of the South Bay interchange ramps (I-93) and Massachusetts Avenue is the source of some congestion in the area. The Central Artery reconstruction may result in modifications to this interchange and the local roadway network in the area. The MBTA should review DPW plans for changes when available to assure that bus operations are improved.

4. Segment D: Melnea Cass Boulevard from Massachusetts Avenue to Ruggles Station

No significant bus operation delay occurs in this segment at the present time. Exclusive left turn lanes are provided at the intersections with Tremont and Harrison Streets. The other major signalized intersections at Shawmut Avenue, Albany Street, Hampden Street and Massachusetts Avenue do not have exclusive turn lanes. Since right-of-way exists, Melnea Cass could be widened to provide turn lanes at all these intersections. Bus pull outs also could be constructed within the right-of-way.

5. Segments E, F, G and H: Ruggles Station to Charles River

These segments were subjected to a much more detailed analysis and evaluation and are discussed in the final section of this chapter



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VI-1
TSM Corridor Segments

6. Segment M: Allston Turnpike Interchange

The Executive Office of Transportation and Construction (EOTC) and the Massachusetts Turnpike Authority are studying alternatives for routing hazardous cargo carrying trucks from the Allston Turnpike interchange over the Grand Junction Railroad Bridge to Cambridge. The route would follow the Grand Junction right-of-way, which runs parallel to the turnpike and crosses the Charles River utilizing the rail bridge (under the Boston University Bridge). At present, trucks carrying hazardous materials must leave the Turnpike at the Allston interchange (they are not allowed to travel through the Prudential Center/Copley Place tunnel) and follow circuitous and often congested routes through Cambridge. If express buses operating on the Turnpike were also allowed to use this new connection, transit service to University Park, MIT, Kendall Square, East Cambridge, Lechmere and the Charlestown Navy Yard could be improved significantly.

7. Segment I: Boston University Bridge (Cambridge side) to Massachusetts Avenue

The City of Cambridge is studying roadway modifications in the area bounded by Massachusetts Avenue, Vassar Street, Sidney Street and the Boston University Bridge to support redevelopment within the area. Possible improvements include the development of a one-way traffic pair between Memorial Drive and Massachusetts Avenue and the improvement of the intersection of Massachusetts Avenue and Main Street. The MBTA should monitor the planning and design of these improvements to insure that adequate consideration is given to actions that would support improved bus services in the area.

8. Segment J: Massachusetts Avenue to Kendall Square

Kendall Square redevelopment and the reconstruction of the Red Line Station have provided for a bus loop through the area and layover space for buses adjacent to the new station. As currently designed buses travelling from west to east would be required to make a circuitous loop along Vassar, Broadway and Main Streets to reach the layover area. Direct access to Kendall Station could be provided by allowing buses to turn right from Vassar Street to Main Street. From here buses could proceed directly to East Cambridge and Lechmere if a left turn were allowed from Main Street to Third Street. However the current design of Main Street restricts this movement. A cut out exists for emergency vehicle access which could be modified to allow this connection for buses. This change would necessitate an enforcement program to restrict automobile movements.

9. Segment K: Kendall Square to Lechmere Station

This segment traverses an area of significant construction activity involving both private development and modifications to the street and roadway network. At the present time congestion is experienced in a number of areas. The completion of the Binney Street extension and other construction in the Kendall Square area should result in some improvement. However, as traffic volumes associated with new development in Kendall Square, East Cambridge and Lechmere grow new problems may develop. Therefore, it is recommended that the MBTA monitor this situation and work closely with the City of Cambridge to identify solutions as problems develop. The most likely segments requiring attention will be in the First Street area approaching Lechmere Station. In addition, the design of the new Lechmere Station should provide for efficient bus movement between Kendall and Bunker Hill Community College, particularly given the growing traffic congestion on the Gilmore Bridge and the Monsignor O'Brien Highway.

The intersection of Austin Street (Gilmore Bridge) and the Monsignor O'Brien Highway experiences significant congestion at present. Peak hour queues often extend across the Gilmore Bridge as far as Rutherford Avenue in Charlestown. No analysis of this intersection has been undertaken as part of the Circumferential Study; however it appears that the problem is most acute during the morning rush hour and involves the approach from Charlestown. As a result, this condition is likely to worsen given the quantity of new development occurring in the areas of Cambridge accessed by this route from I-93. Therefore, work to identify possible solutions or alternative bus routings to avoid the area should be pursued.

10. Segment L: Lechmere Station - Charlestown Navy Yard

The CANA project will totally reconfigure the City Square area of Charlestown, which historically has been the location of significant congestion. The proposed design creates a major intersection

between Rutherford Avenue, Chelsea Street, and the ramps to and from the CANA interchange (I-93 and Route 1). Virtually all access to the Charlestown Navy Yard will pass through this intersection. Both the City of Boston and the State have reviewed the proposed design of this intersection and come to different conclusions as to whether it will operate at an acceptable level of service. Resolution of this issue now awaits an analysis based on traffic forecasts that are being prepared as part of the Central Artery Supplemental Environmental Impact Statement (SEIS). Since this intersection is crucial to all transit access to the Navy Yard, the MBTA should monitor this process and gain assurance that buses will not suffer undue delay during peak periods.

Vehicular access to the interior of the Charlestown Navy Yard can be gained only from Chelsea Street through either Gate #4 or Gate #5. Scheduled MBTA bus service does not now enter the Yard. An analysis of the geometrics of both gates indicates that right turn movements either in or out of the Navy Yard at these gates is very difficult for standard transit coaches because of the narrow approach width on both Fifth Street (Gate #4) and Thirteenth Street (Gate #5). To solve these problems the widening of both gates has been analyzed. While from a physical standpoint both improvements are possible, only the Gate #5 approach can be accomplished without major construction. The widening of Gate #4 would require the relocation of a retaining wall and acquisition of property from the National Park Service. An alternative approach that would not require this construction would be to open Gate #1 to exclusive use by transit and other high occupancy vehicles (vans, school buses, and tour buses). If this were done MBTA buses might be operated through the Navy Yard, either one way or two way from Gate #1 to Gate #5 via First Avenue. (Under a one way loop buses might enter the Yard through Gate #1, exit via Gate #5, and return to City Square using Chelsea Street.) It is recommended that the MBTA work closely with the City of Boston and the National Park Service to resolve this issue.

B. GREATER LONGWOOD AREA IMPROVEMENTS

One of the most severely congested areas in the corridor are the arterials which connect Ruggles Station on the Orange Line to the Boston University Bridge crossing of the Charles River to Cambridge. These links, through the Northeastern University, Longwood, Fenway, and Boston University areas, were studied in much greater depth than the other segments to determine possible roadway improvements.

The corridor through this area is currently served by the Route 47 bus, which runs from Andrew Square on the Red Line to Central Square in Cambridge, and the Route 47A, which connects Boston City Hospital to Kenmore Square. Also serving the area are four bus routes operated by the Medical Area Service Corporation (MASCO), providing connections to Kenmore Square, Fenway Park, Cambridge, and parking facilities in the Brookline/Allston area. In addition, the short term bus analysis identified a new Route 229 that might connect through the area from Ruggles Station to points in Cambridge and ultimately the Charlestown Navy Yard.

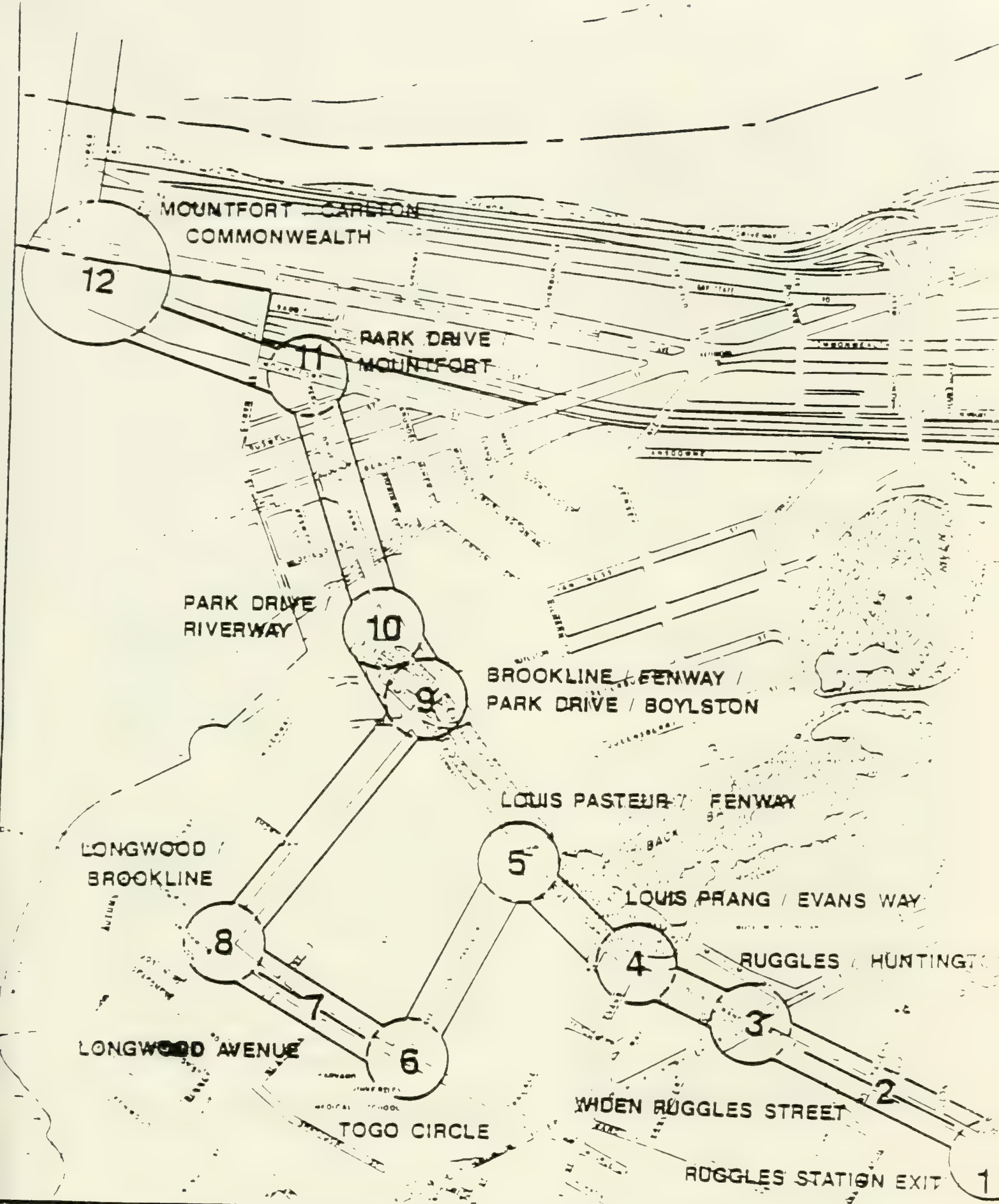
The analysis undertaken involved data collection and observations regarding existing transit and traffic operations along the entire corridor from Ruggles Station to the Charles River. In addition, MASCO has recently completed a comprehensive study of the area, which provides much valuable information.

The study area was subdivided into twelve links which were analyzed in detail. This produced a series of recommended roadway modifications and operation changes in the corridor. These improvements are designed to improve current bus operations in the Longwood area, as well as enhance the ability of the proposed new bus routes to serve trips in the corridor between Ruggles and points in Cambridge. Recommendations are summarized in the following sections for the corridor segments illustrated in Figure VI-2.

- **Segment 1: Ruggles Station Exit** - a minor widening of the exit from Ruggles Station to Ruggles Street to allow re-striping for separate left and right turn bus lanes is recommended.

- **Segment 2: Ruggles Street** - from Ruggles Station to Huntington Avenue should be widened as currently planned by the MBTA and Boston Transportation Department (BTD) to provide two travel lanes in either direction - 32 foot right of way should be retained for future development of a fixed transit facility (light rail, mini metro, or guided bus).

- **Segment 3: Huntington Avenue** - at the Ruggles Street and Louis Prang Street intersection traffic signal timings should be revised to optimize operation given present traffic flows. The Louis Prang Street leg should



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VI–2

Greater Longwood Area TSM Improvements

be re-striped to provide two entry lanes and one exit lane. This will require limited removal of on-street parking on the south side of the roadway.

- **Segment 4: Fenway Avenue/Louis Prang Intersection** - the existing flashing traffic signal operation should be changed to provide a yellow indication for through movements from Fenway to Louis Prang. Minor adjustments to the roadway striping should be considered to clarify movement in the area.
- **Segment 5: Fenway Avenue/Louis Pasteur Intersection** - the bus stop on Avenue Louis Pasteur for buses bound for Longwood Avenue should be relocated further from the intersection with Fenway to allow buses to stop at the curbside. The present location makes it very difficult for buses to maneuver to the curb.
- **Segment 6: Avenue Louis Pasteur/Longwood Avenue Intersection** - The MBTA bus stop on Avenue Louis Pasteur near Togo Circle for buses bound for Longwood Avenue should be relocated closer to the existing MASCO bus stop. The latter is currently often used by MBTA buses and is in a better location for buses to pull to the curb. Roadway and crosswalk striping in the Togo Circle area should be improved to better delineate pedestrian movements in the area.
- **Segment 7: Longwood Avenue** - between Avenue Louis Pasteur and Brookline Avenue passes through the core of the hospital area. All existing on-street parking and loading, with the exception of bus stops, on Longwood Avenue between Avenue Louis Pasteur and Binney Street should be removed. Longwood should be re-striped from Avenue Louis Pasteur to Binney Street to provide a single, wide travel lane in either direction. An enforcement program should be implemented to maintain curb use restrictions throughout this section, and the MBTA should enforce operator rules to insure that buses pull completely out of the travel lane into designated bus stops.
- **Segment 8: Longwood Avenue/Brookline Intersection** - Traffic signal timing should be optimized based on existing traffic conditions. On-street parking and loading should be eliminated from both sides of both approaches on Brookline Avenue, and exclusive left turn lanes should be provided for all left turns to both directions of Longwood by re-striping the two Brookline Avenue approaches. The existing bus stop on Brookline should be relocated away from the Longwood Avenue intersection to allow the addition of the left turn lanes. The Longwood Avenue approach from the medical area should be widened to provide an additional lane for right turns, and the curb radius should be increased to allow better bus operations. The widening of the Longwood approach and modifications to the curb radius might be accomplished as part of the redevelopment of the Massachusetts College of Arts site.
- **Segment 9: Brookline Avenue/Fenway Park Drive/Boylston Street Intersections** - Traffic signal timings should be optimized based on existing traffic conditions.
- **Segment 10: Park Drive/Riverway Intersection** - the eastbound merge of Riverway and Park Drive should be signalized or the roadway layout should be modified to provide stop sign control of the approach from Riverway.
- **Segment 11: Park Drive/Mountfort Street Intersection** - the eastbound approach of Mountfort Street to Park Drive should be re-designed to eliminate the sudden merge of two traffic lanes to one as all traffic turns right at the intersection. This could be accomplished by a re-alignment of the curb line or by the re-striping of Mountfort Street to force the merge prior to the right turn to Park Drive.
- **Segment 12: Mountfort Street/Carlton Street/Commonwealth Avenue Intersection** - the Carlton Avenue approach to Commonwealth Avenue should be re-striped to provide proper lane definition. Roadway signage on the Commonwealth Avenue eastbound approach should be improved to encourage the use of the reverse [illegible] turn arrangement to the Boston University Bridge

VII. LONG RANGE ALTERNATIVES

This chapter describes the Circumferential Line long range alternatives. The development of alternative elements is discussed first, including right-of-way options, service concepts, and technology alternatives. This is followed by a description of the initial alternatives, findings of the first stage evaluation, and the generation of the eight detailed alternatives. Also included is a description of the Transportation Systems (TSM) alternative, which provides the basis for the recommended mid-range street and highway improvements detailed in Chapter VI.

A. ALTERNATIVES GENERATION

The sketch plan analysis identified the primary corridor as extending from Ruggles Station on the Southwest Corridor/Orange Line, through the Longwood and Boston University areas, across the Charles River to Cambridge, through the University Park/MIT area, Kendall Square and Lechmere, and terminating at either Community College Station or Sullivan Square Station on the Orange Line. A number of additions to this basic corridor were identified including the following:

- Ruggles Station to the Boston City Hospital area.
- Boston City Hospital area to JFK/U Mass on the Red Line.
- JFK/U-Mass on the Red Line to Columbia Point.
- Boston City Hospital area to South Station.
- Boston City Hospital area to South Boston Piers area.
- South Boston Piers to Logan Airport.
- Logan Airport to Airport Station on the Blue Line.
- Longwood Medical area to Kenmore Square Station on the Green Line.
- Kenmore Square to Kendall Square Station on the Red Line.
- Kendall Square to Sullivan Square Station on the Orange Line.
- Community College to Sullivan Square.
- Community College to the Charlestown Navy Yard.
- Charlestown Navy Yard to Airport Station on the Blue Line.
- Charlestown Navy Yard to Sullivan Square, and
- Sullivan Square to Airport Station via Everett and Chelsea.

Figure VII-1 illustrates both the general corridor and the possible corridor extensions.

1. Right-of-Way Analysis

For each of the identified linkages possible right-of-way was assessed based on available transit facilities, existing and future streets/highways, railroads, and vacant or underutilized land. Where right-of-way did not exist a preliminary analysis of the least disruptive connection was undertaken. This process identified 24 generalized right-of-way segments as illustrated in Figure VII-2. These segments were field checked and evaluated based on possible development for both bus and fixed guideway transit facilities. Descriptions of the segments analyzed and general conclusions of the evaluation are as follows:

a. Segment 1 - JFK/U Mass (Red Line) to Columbia Point: Previous MBTA studies of alternative alignments and technologies in this area concluded that demand did not warrant large investments in fixed facilities to serve the major traffic generators of the University of Massachusetts campus, JFK Library, Bayside Exposition Center and Harborpoint Housing development. Surface bus operations interfacing with the Red Line and the Circumferential Line at the existing station appear adequate to meet all future needs. As a result this segment was dropped from further consideration.

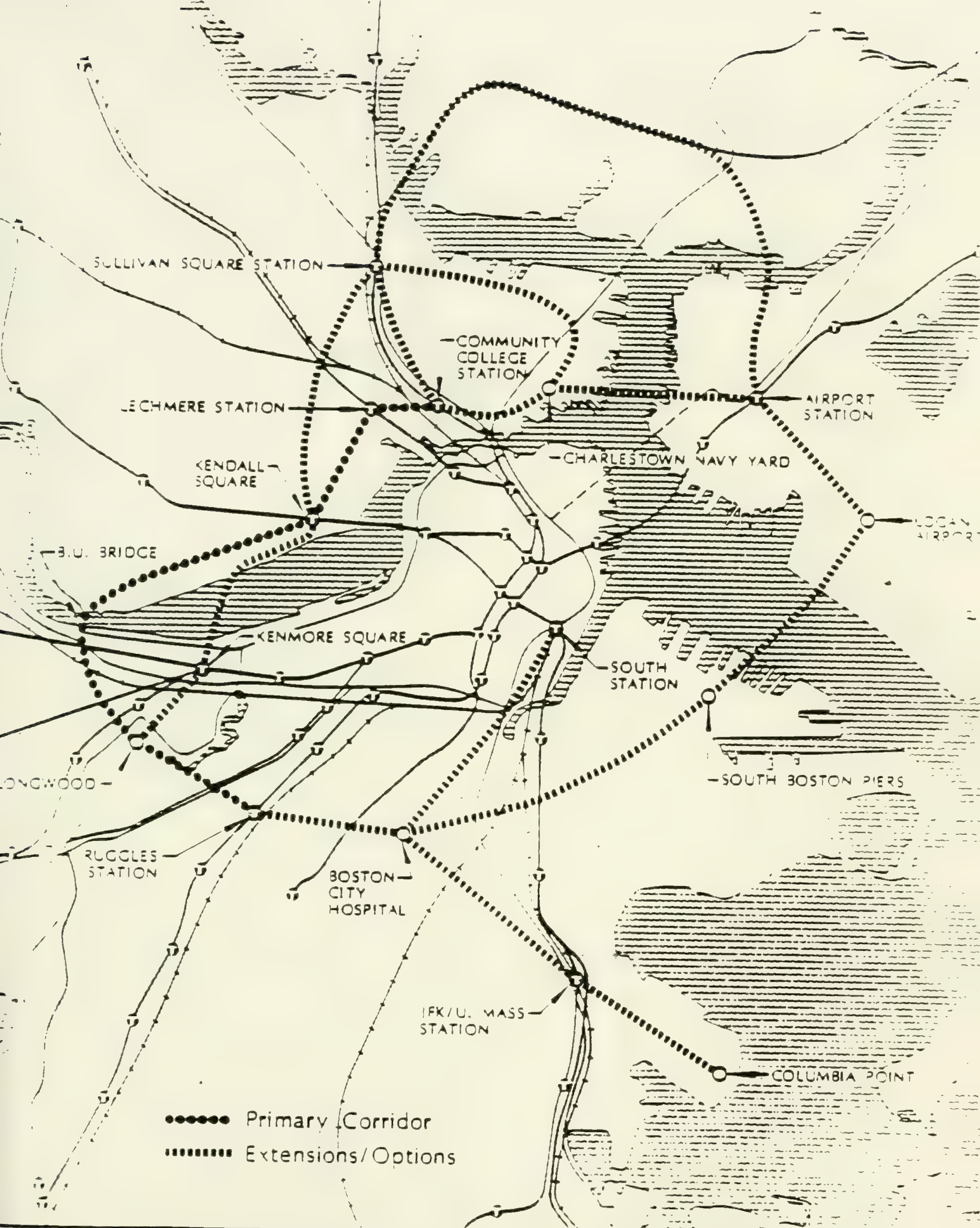


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FIGURE VII-1
Conceptual Linkages

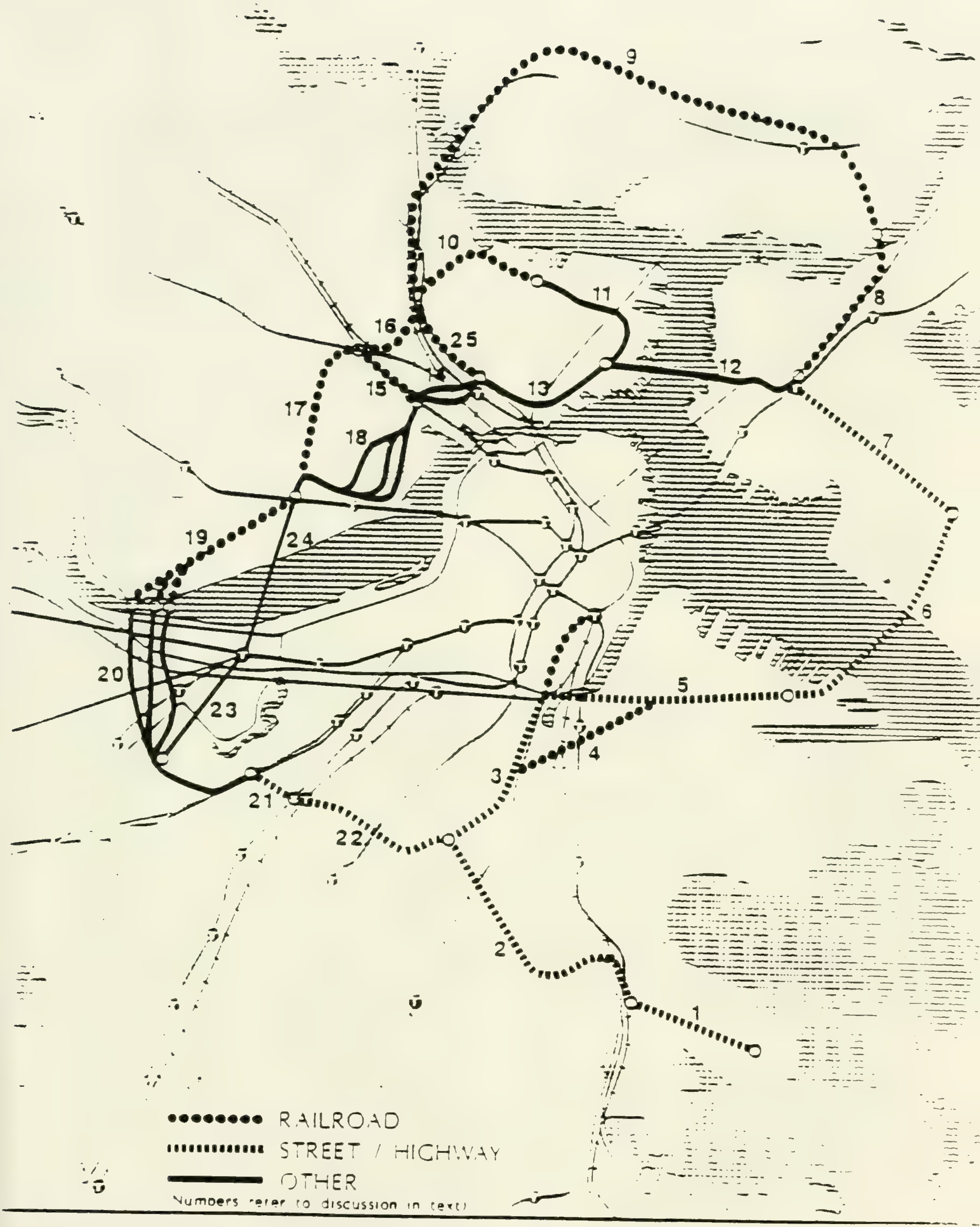

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FIGURE VII-2
Candidate Rights-of-Way

b. **Segment 2** - JFK/U Mass (Red Line) to Melnea Cass Boulevard: Limited surface street right-of-way is available along Columbia Road and Massachusetts Avenue to Melnea Cass Boulevard. Mixed traffic bus operations are possible, but light rail would require right-of-way acquisition for surface operation. A full subway segment is probably not required, although grade separation at the intersection of Massachusetts Avenue and the Southeast Expressway ramps is desireable because of traffic congestion.

c. **Segment 3** - Melnea Cass Boulevard to South Station: Limited right-of-way is available along Albany Street to the vicinity of the Massachusetts Turnpike. From the Turnpike to South Station the existing rail facilities are highly used and right-of-way is limited. With connections provided by Segments 1 and 2 and the Circumferential interface at Ruggles Station, this segment is redundant for distribution from the Red Line south and the commuter rail lines. Therefore, it was dropped from further consideration.

d. **Segment 4** - South Boston Conrail Cut: This right-of-way is to be developed as a haul road and bypass for South Boston as part of the Seaport Access Road and Third Harbor Tunnel construction. It could be used for bus service, but fixed rail development would be difficult unless in a subway segment. Given this and the possible redundancy with the South Boston Piers transit connections from South Station, further consideration was dropped. This segment could, however, play a role as a possible connection to the Circumferential Line if the latter were developed as a guided bus facility.

e. **Segment 5** - Seaport Access Road: This I-90 segment will extend the Massachusetts Turnpike to the portal of the Third Harbor Tunnel. As currently planned it will include facilities for preferential bus access to the tunnel, providing bus connections to South Station and the Turnpike. The alignment has been considered for the Red Line Loop alternative in the South Boston Piers Transit Study. For this reason and the conclusions from the analysis of Segment 4 above it was dropped from further study. This segment could, however, play a role as a possible connection to the Circumferential Line if the latter were developed as a guided bus facility.

f. **Segment 6** - Third Harbor Tunnel: As now planned the tunnel will provide four lanes from the Seaport Access Road to Logan Airport. No transit right-of-way is to be provided in the tunnel, however, buses will be provided preferential access on both approaches. Because of this, no further consideration was given to the tunnel as part of the circumferential alignment. This segment could however play a role as a possible connection to the Circumferential Line if the latter were developed as a guided bus facility.

g. **Segment 7** - Third Harbor Tunnel to Airport (Blue Line): The internal roadway system at Logan Airport is to be reconstructed as part of the Third Harbor Tunnel. In addition, Massport is studying the possibility of connections between the Blue Line and a new "central processor" at the airport. Since decisions have yet to be made on the most appropriate means of internal airport transit, this segment was not considered further. However, depending on the outcome of Massport's studies this link might become part of an extended Circumferential Line from the vicinity of the existing Airport Station on the Blue Line.

h. **Segment 8** - Conrail ROW from Airport (Blue Line) to Chelsea River: This right-of-way could be utilized for either surface bus or fixed guideway transit operation. Possible disruption of freight operations and the need to reconstruct the bridge across the Chelsea River are the major issues with its development.

i. **Segment 9** - Conrail ROW from Chelsea River to Sullivan Square (Orange Line): This segment provides the most likely circumferential alignment to Logan Airport. Up to a 100 foot right-of-way is available in places. It could be developed as a surface facility for either light rail or buses.

j. **Segment 10** - Moran Terminal Rail Spur from Sullivan Square (Orange Line): Only segments of right-of-way are available to make this connection to the Navy Yard, and travel demand to and from the north does not appear large enough to warrant a major investment. Therefore, this link was not considered further in the analysis.

k. **Segment 11** - Moran Terminal to Charlestown Navy Yard: No right-of-way exists to make this connection. Acquisition of new right-of-way does not appear warranted given the likely modest travel demand.

l. **Segment 12** - Fourth Harbor Crossing from Charlestown Navy Yard to Airport (Blue Line): This would require a new tunnel or bridge, and does not appear warranted based on the preliminary travel demand estimates. A passenger ferry connection would be more appropriate if development in the Navy Yard warrants. Therefore, this segment was dropped from further consideration.

m. Segment 13 - Community College (Orange Line) to Charlestown Navy Yard: Limited abandoned rail right-of-way is available in this area. Although part of the right-of-way will be used for the new I-93/Route 1 ramps being developed as part of the CANA project. In addition, the preliminary demand estimates are not large enough to warrant a major transit investment. While this alignment was dropped from further study, bus connections between the Navy Yard and Community College Station are desireable.

n. Segment 14 - Community College (Orange Line) to Lechmere (Green Line): Most of this area is developed in rail yards and will require construction of a new aerial guideway for either buses or rail vehicles.

o. Segment 15 - MBTA ROW Lechmere (Green Line) to Grand Junction Railroad: This segment has been identified as a possible means for extending light rail service from Lechmere to Ball Square. Following an analysis of possible circumferential alignments to connect the Red, Green and Orange Lines it appears to be the least likely of three options identified. Therefore, it was dropped from further study.

p. Segment 16 - Grand Junction Railroad from McGrath Highway to Sullivan Square (Orange Line): This segment could be developed for either bus or light rail surface operation. In combination with segment 17 it forms one of the two most likely means of connecting the Red, Green and Orange Lines in this area.

q. Segment 17 - Grand Junction Railroad from Main Street (Cambridge) to McGrath Highway: This segment could be developed for either bus or light rail surface operation. In combination with segment 16 it forms one of the two most likely means of connecting the Red, Green and Orange Lines in this area.

r. Segment 18 - Intersection of Grand Junction Railroad and Main Street (Cambridge) to Lechmere: Right-of-way to provide this connection from the Grand Junction Railroad to Kendall Square Station on the Red Line and Lechmere Station on the Green Line is very limited. A subway segment is probably required between the Grand Junction Railroad and Kendall beneath Broadway, while limited surface operation may be possible between Kendall and Lechmere for either light rail of buses. This is the other of the most promising means of connecting the Red, Green and Orange Lines.

s. Segment 19 - Grand Junction Railroad from Boston University Bridge to Main Street in Cambridge: After initial analysis this segment does not appear feasible for surface operation of either buses or light rail. The right-of-way narrows to [illegible] feet in places, and given rail freight and commuter rail use of this segment, joint operation of buses or light rail does not appear possible. The right-of-way would be an attractive and less disruptive alignment for a subway segment, however.

t. Segment 20 - Boston University Bridge to Huntington Avenue and Ruggles Street: No right-of-way exists for this key link across the Charles River and through the Boston University and Longwood areas. The area is highly developed and environmentally sensitive. A subway segment appears the only feasible alternative for this connection.

u. Segment 21 - MBTA ROW Ruggles Street from Huntington Avenue to Ruggles (Orange Line). The transit easement here could be utilized for either surface or subway development and provides the most logical link from Ruggles Station.

v. Segment 22 - MBTA ROW Melnea Cass Boulevard from Ruggles Station (Orange Line) to Massachusetts Avenue: The transit easement here could be utilized for either surface or subway development and provides the most logical link to the southeast from Ruggles Station.

w. Segment 23 - Brookline Avenue from Longwood to Kenmore Square: While no right-of-way is available an optional alignment to connect the Longwood area to the B, C and D Branches of the Green Line would be a routing through Kenmore Square and then across the river to Cambridge. A subway section is probably the only feasible approach here.

x. Segment 24 - Kenmore Square (Green Line) to Kendall Square (Red Line): This would form the other segment needed for the option to the Grand Junction connection across the Charles River and through Cambridge. A subway section appears the only feasible approach here.

2. Service Concepts

The preliminary demand analysis, discussed in Chapter IV, indicated that two general types of [illegible] take place in the corridor. Slightly less than [illegible] percent of travel demand is for interchanges among origins and destinations totally within the circumferential corridor, while over 60 percent

demand is for trips having one end in the corridor and one end elsewhere in the region. In the case of the latter circumferential service would perform a collection and distribution function for the other radial lines of the MBTA transit system. As a result, two general concepts were identified to serve travel demand in the corridor as follows:

- **Fixed Circumferential Corridor:** Under this concept service would operate totally within the corridor connecting the major activity centers and crossing all the radial transit lines. Trips to and from points outside the corridor would require transfers at those points where the circumferential service intersects each radial line. Under this concept all the technology options considered including conventional and guided bus, light rail, and fully grade separated rapid transit would be possible. The corridor might be served by a single continuous line, running from end to end. Alternatively, concurrent lines might operate in the corridor providing appropriate levels of service based on the varying demand in the corridor segments. Figure VII-3 illustrates this concept.
- **Radial/Circumferential Corridors:** Under this concept the corridor would be served by a network of lines which would have both a radial component and a circumferential component. Under this concept lines would approach the corridor from points elsewhere in the region and then travel along a segment of the corridor. The idea would be to structure the system to minimize the volume of transfers that would have to take place for those trips which have regional origins or destinations and only collection and distribution along the corridor. By minimizing transfers for the majority of trips it was hoped that a more attractive system could be provided. The existing radial transit system would limit technology options under this concept to either conventional or guided buses or light rail. Figure VII-4 illustrates this concept.

3. Technology Alternatives

Five generalized transit technologies were identified for long term development of the circumferential corridor. Three of these technologies, conventional diesel bus, light rail, and intermediate rapid transit (Blue Line) are currently operated by the MBTA and two of the technologies, dual propulsion guided bus and automated people mover would be new to the MBTA system. Because of the corridor characteristics of constrained rights-of-way and likely short station spacings with high transfer volumes, heavy rail rapid transit such as Red and Orange Line vehicles and commuter rail are inappropriate.

Following an initial screening of options, a decision was made to structure the long term alternatives around four general technology categories. These are summarized in the following sections and illustrated in the accompanying Figures VII-5 through VII-10.

a. Conventional Bus

For both the Base and TSM alternatives service in the corridor would be provided by conventional 40 foot diesel-powered transit coaches similar to those now operated by the MBTA.

FIGURE VII-5

40 Foot RTS-II Diesel Bus

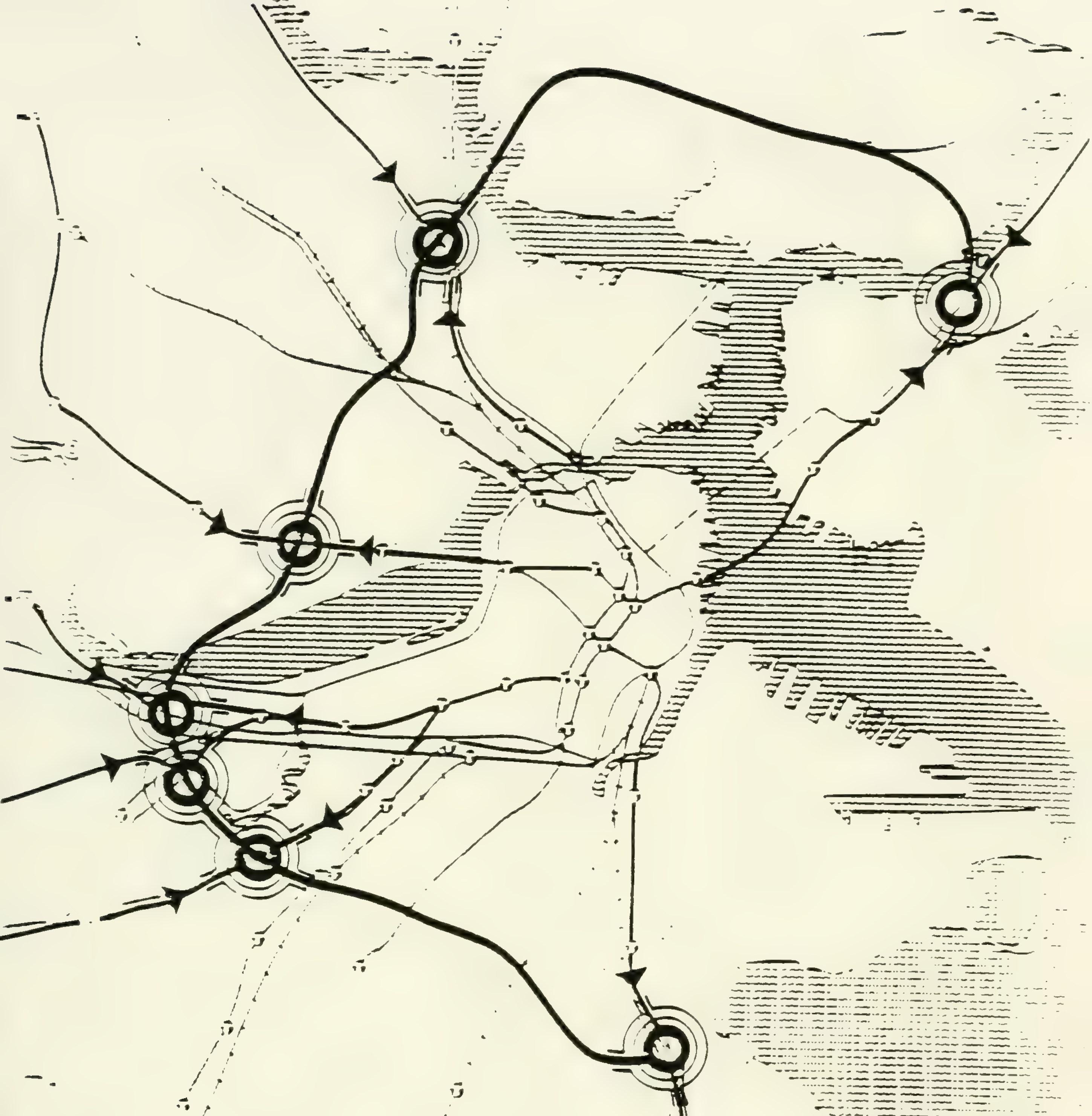

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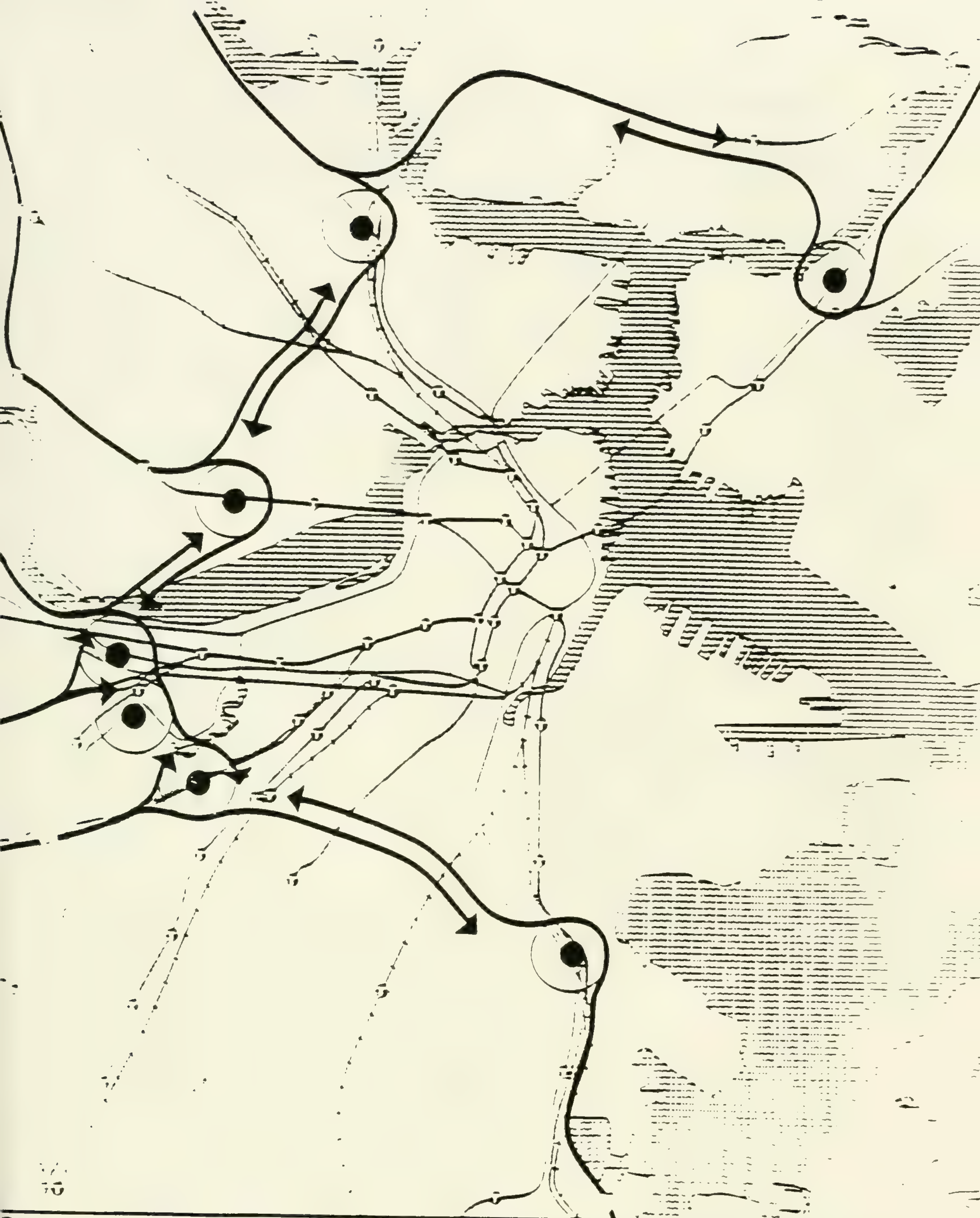
FIGURE VII-3

Fixed Circumferential Corridor



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VII-4
Radial Circumferential Corridors

FIGURE VII-6

BN Center Guided
Dual Propulsion Bus

FIGURE VII-7

MAN Side Guided
Dual Propulsion Bus

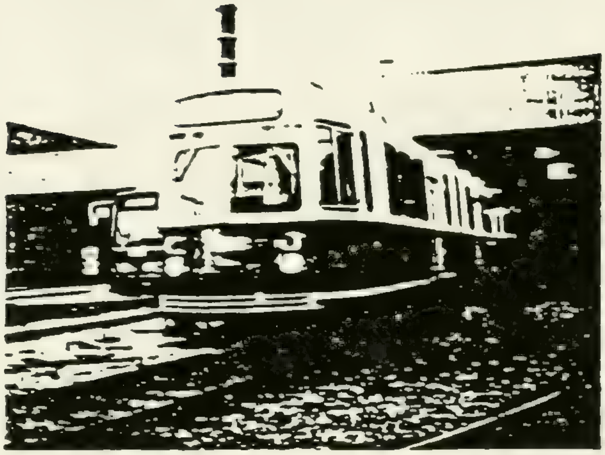
b. Dual Propulsion Guided Bus

Guided buses are vehicles equipped to automatically steer all steerable axles as the bus travels along a specially equipped roadway. Outside the guideway the vehicle is manually steered by the driver who is always on-board the vehicle. The steering signal can be generated mechanically or electrically. Under mechanical control, guidance can be achieved through either center or side guides. The dual propulsion capability allows operation as a conventional diesel bus in normal traffic conditions and as an electric trolley bus while operating on the transit guideway. For purposes of generating a guided bus alternative, a 60 foot long articulated vehicle was assumed. Guided bus technology is under development by a number of European manufacturers. Revenue service operations now exist in Germany and Australia. The dual propulsion capability has been more widely applied in both Europe and North America. The subway now under construction in Seattle will utilize a dual propulsion non-guided 60 foot articulated bus.

The guided bus technology has significant potential for serving the circumferential corridor because of its capability to operate both on and off the guideway. This would allow radial service in general traffic on facilities such as the Massachusetts Turnpike and then circumferential service on an exclusive guideway within the corridor, all with the same vehicle. The guidance capability would allow narrower tunnels and structures and possible joint operation with other rail vehicles in areas such as the Grand Junction Railroad and the Green Line facilities west of Kenmore Square. Finally guided buses might allow phased or even partial development of the circumferential corridor since discontinuities in the guideway would not limit where service could be provided. Guided, dual propulsion buses are also one of the alternatives under analysis in the South Boston Piers Transit and the Washington Street Replacement Service Studies.

FIGURE VII-8

MBTA Type 7
Green Line LRT



c. Light Rail

Light rail technology similar to the existing Green Line Type 7 vehicle is another attractive option for the circumferential corridor. While light rail would require continuous development of a guideway, the nature of the guideway could vary from full grade separation where warranted to at-grade operation along existing streets and rail lines. Light rail would also allow the routing of radial to circumferential service along the four existing branches of the Green Line as well as the planned Lechmere extension to Ball Square. Green Line, light rail technology is one of the options being analyzed in the South Boston Piers Transit and Washington Street Replacement Studies.

d. Mini Metro

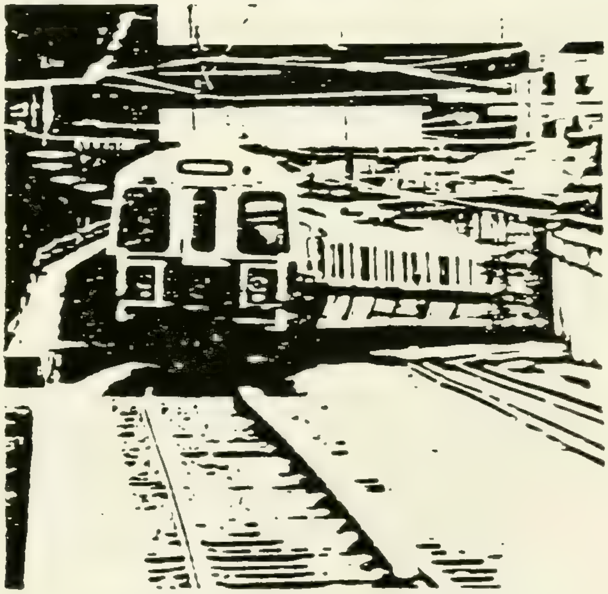
Mini metro is a term which refers to a variety of intermediate capacity fully grade separated transit technologies. These systems vary from driver controlled rail systems such as the existing Blue Line to automated rail and rubber-tired vehicles such as the new transit systems in Vancouver, Detroit, Miami and Toronto, and the people mover systems operated at a number of airports. The mini metro technology would provide the fastest and highest capacity system of those technologies analyzed for the corridor. It would also require the most expensive, fully grade separated right-of-way. People mover technologies are also under analysis as part of the South Boston Piers Transit Study

FIGURE VII-9

Vancouver UTDC
Automated Rapid Transit

FIGURE VII-10

MBTA Blue
Line Vehicle



4. Identification of Initial Alternatives

Six initial alternatives were generated. The objective was to test the feasibility of a wide range of options to identify the most promising concepts for refinement and evaluation of cost effectiveness. These alternatives included:

- **Alternative 1: Baseline** - was a year 2010 "no action" option which included no corridor improvements, but all other MBTA system improvements described in Chapter II.

- **Alternative 2: TSM** - or Transportation Systems Management, included the low cost traffic improvements described in Chapter VI and expanded bus services in the corridor.

- **Alternative 3: LRT/Circumferential** - was designed to test the effectiveness of a light rail line operated solely in the corridor between JFK/U Mass on the Red Line and either Lechmere or the Charlestown Navy Yard.

- **Alternative 4: LRT/Radial-Circumferential** - was designed to test the effectiveness of integrating radial service on the Green Line Branches with operation in the circumferential corridor. Included were three light rail lines. One line would operate from JFK/U Mass on the Red Line to Sullivan Square on the Orange Line. A second line would operate from Riverside on the D Branch of the Green Line, enter the circumferential corridor at Longwood, proceed across the Charles River to University Park/MIT, then through Kendall Square, and terminate at Lechmere. A third line would run from Ball Square on the proposed Green Line extension to Lechmere, enter the circumferential corridor, travel through Cambridge, cross the Charles River to Longwood, and terminate at Ruggles Station on the Orange Line.

- **Alternative 5: Mini Metro** - was designed to test the effectiveness of a rapid, higher capacity system serving the primary corridor and all potential extensions. The primary line examined would run from JFK/U Mass on the Red Line south to a point between Kendall and Central Squares on the northwest leg of the Red Line. From here two alternative extensions were examined. One would continue along the Grand Junction Railroad through East Cambridge, Somerville, Everett, Chelsea, and East Boston, terminating at Logan Airport. A second would run to Kendall Square, Lechmere, Bunker Hill Community College, the Charlestown Navy Yard, and then cross the harbor to Logan Airport.

- **Alternative 6: Guided Bus** - was designed to cover the entire corridor from JFK/U Mass on the Red Line to Logan Airport with bus routes having both radial and circumferential components. Initially, six separate routes were analyzed.

5. Evaluation of Initial Alternatives

The six initial alternatives and suboptions were then subjected to a preliminary evaluation. This work included an analysis of the potential for developing the alternative route segments for the technology under consideration and preliminary forecasts of ridership. Significant conclusions from this work are summarized in the following sections

a. Right-of-Way Analysis:

Key general conclusions of the right-of-way assessment for the six options included:

- Existing street segments between JFK/U Mass and Ruggles Station appear useable for surface operations for all of the options except the mini metro, which requires full grade separation

- The intersection of the Circumferential Line and Massachusetts Avenue/Albany Street probably will require grade separation for all options except the conventional and guided bus

- Regardless of the technology chosen the segment of the corridor between Ruggles Station and the Charles River is very difficult to develop. The options appear to be either buses running on existing surface streets or the construction of a subway for the other technology alternatives.

- Crossing of the Charles River will require a new tunnel for both the light rail and mini metro options. Conventional and guided buses could use either the existing Boston University Bridge or a reconstructed Grand Junction Railroad Bridge.

- The Grand Junction Railroad from the Charles River Bridge to Main Street is not useable for shared rail freight, commuter rail and transit operations regardless of transit technology. The right-of-way is quite narrow in a number of locations and mixing vehicle operation presents serious operational and institutional

problems. Both the light rail and mini metro alternatives probably will require subway construction in this segment. Conventional and guided buses could operate on parallel surface streets.

- Development of a new Red Line Station to interface with the Circumferential Line between Kendall and Central Square Stations probably is not feasible, because of impacts on Red Line operations and the proposed turnback loop to be built beneath the Grand Junction Railroad. The most likely interface is at Kendall Square Station.
- The Grand Junction Railroad and Conrail facilities extending from Main Street in Cambridge through Everett and Chelsea to Logan Airport appear useable for joint freight rail and light rail or guided bus operations.

b. Ridership Analysis

Conclusions from the patronage forecasting for the initial alternatives included the following:

- Ridership in the corridor was highest on the core segment between Ruggles Station and either Community College or Sullivan Square. Link volumes were high enough to continue consideration of all options for this segment.
- Ridership on extensions beyond these two end points did not appear high enough to warrant further consideration of the high cost mini metro technology
- Extension of fixed guideway transit from Community College to the Charlestown Navy Yard did not appear justifiable based on the ridership potential.
- A new harbor crossing from the Navy Yard to Logan Airport for transit did not appear warranted based on the ridership forecasts.
- The light rail alternative which included combined radial and circumferential service on the same routes did not perform as well as the purely circumferential light rail option. While the former greatly reduced transfers, the longer headways resulting from the multiple routes more than offset any travel time advantage.

B. LONG RANGE ALTERNATIVES

Based on the results of the initial evaluation the long range alternatives were refined into eight distinct options for the purpose of the detailed evaluation and analysis of cost effectiveness. The following sections describe the final long range alternatives in detail.

1. Alternative 1 - Baseline

This alternative is the baseline or "no action" 2010 design year transit service in the circumferential corridor. The purpose of this option was to provide a basis of comparison for the seven action alternatives. While this alternative did not include any improvements in the circumferential corridor, it did include a number of radial transit improvements as described in Chapter III under the description of the year 2010 MBTA transit system.

2. Alternative 2 - TSM

The TSM or Transportation Systems Management alternative consisted of low cost traffic improvements, the addition of new bus routes and modification of existing bus routes to improve bus service in the circumferential corridor. Also included was a series of new express bus routes designed to provide peak period commuter service primarily from the western suburbs to areas in the circumferential corridor. The traffic improvements were subjected to a detailed analysis and resulted in the recommendations presented in Chapter VI. The corridor bus improvements were refined through the short term bus analysis and resulted in the recommendations presented in Chapter V.

The express bus system was refined from that initially analyzed and included four peak period commuter routes as illustrated in Figure VII-11. Three routes (E1, E2, and E3) would utilize a new Turnpike exit ramp which provides a direct connection to the Grand Junction Railroad Bridge, crossing the Charles River to Cambridge. Development of this ramp is currently under study by the EOTC and the Turnpike Authority for use by trucks. In addition, roadway changes in the area of Cambridge bounded by Massachusetts Avenue, Vasser Street, Sidney Street and the Boston University Bridge are anticipated as a result of the University Park development. All three routes would utilize these new arterials to gain access to Kendall Square, East Cambridge, Lechmere, and the Charlestown Navy Yard. Route E1 would originate in Waltham and provide express service to

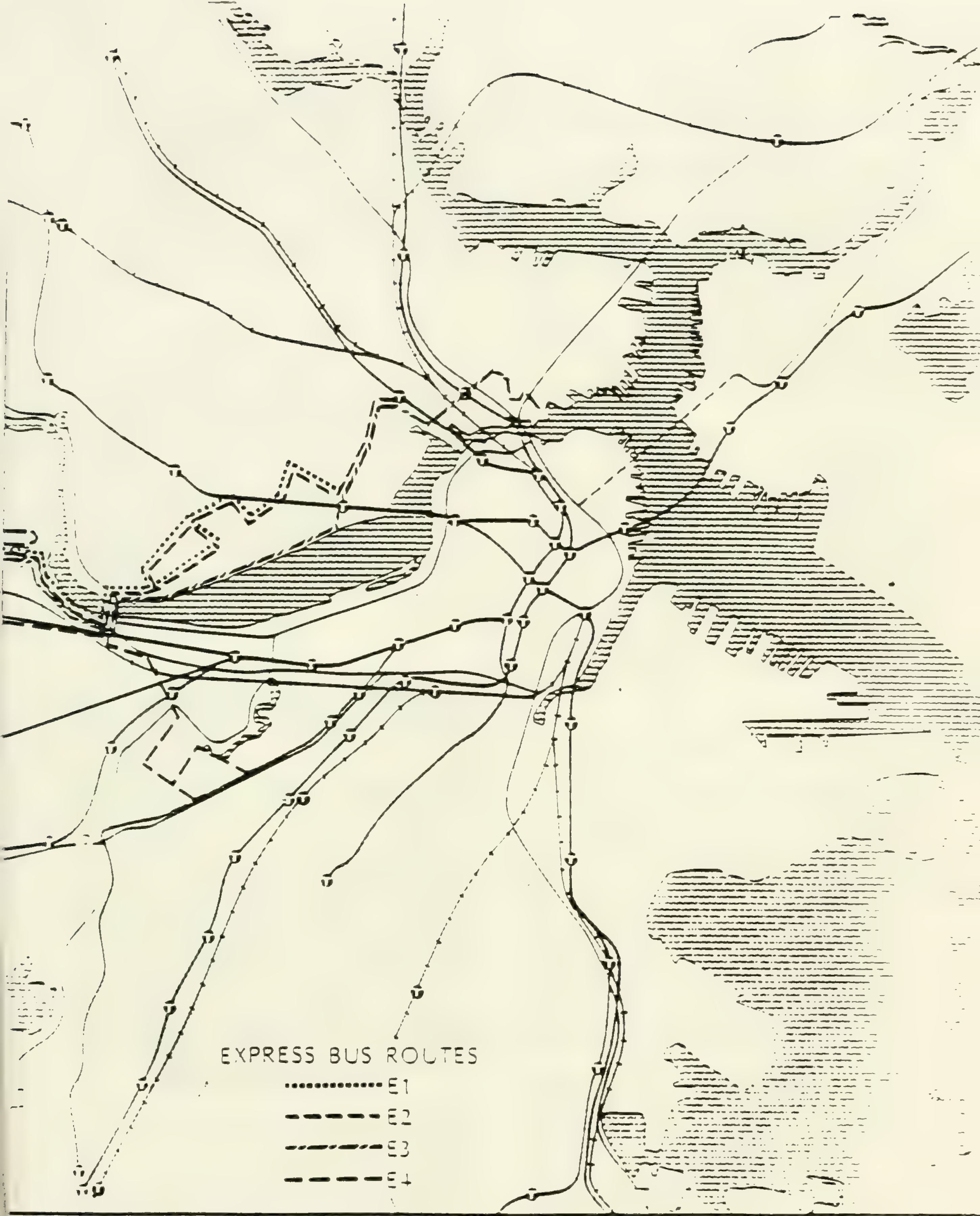


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FIGURE VII-11

Alternative 2 : TSM (Express Bus Routes)

Kendall Square with an intermediate stop to serve University Park and MIT. Route E2 would originate in Riverside and continue as far as Lechmere with intermediate stops to serve University Park, MIT and Kendall Square. Route E3 would provide express service from Framingham to Lechmere, East Cambridge, and the Charlestown Navy Yard. A fourth express route (E4) would originate in Watertown and provide service to the Longwood Medical Area.

3. Alternative 3C - Core LRT

This alternative is the simplest of the light rail options and would consist of a single line connecting Ruggles Station on the Southwest Corridor/Orange Line to Community College Station on the northern leg of the Orange Line, as illustrated in Figure VII-12. It would consist of approximately 5.1 miles of double-track light rail, predominantly in subway. A total of ten new stations would be constructed, two at-grade, one on aerial structure, and seven in subway. Also included is an expanded maintenance and storage facility at Lechmere and new commuter rail platforms on the Framingham Line near St. Mary's Street and on all North Station lines at Community College.

The line would operate at grade from a terminal point at Ruggles Station along the transit easement on Ruggles Street, enter a subway portal near Huntington Avenue, continue through the Longwood area in subway, crossing all four branches of the Green Line and passing beneath the Charles River just east of the Boston University Bridge. Stations would be located at Ruggles, with direct Orange Line and commuter rail access; beneath Huntington Avenue near Longwood Avenue, with direct E Branch connections; beneath Longwood Avenue at Binney Street; beneath Park Drive between Medfield and Beacon Streets, with direct D Branch access from the existing Fenway Station and C Branch access provided by a new Green Line Station beneath Beacon Street at Park Drive; and beneath the BU Campus at approximately St. Mary's and Babbit Streets, with direct Framingham commuter rail line access from a new platform adjacent to the Turnpike and B Branch access at Commonwealth Avenue.

Once across the Charles River to Cambridge the line would continue in subway beneath the Grand Junction Railroad to Main Street. A single station would be located at Massachusetts Avenue providing access to MIT and the University Park area. The subway would continue down Broadway to a new Kendall Square Station near Third Street. A pedestrian tunnel would connect the Circumferential Line platform to the Red Line.

From Kendall the subway would continue around the Badger Building and intersect Second Street at Athenaeum Street, where a portal would bring the line to grade. From Athenaeum to Thorndike Street Second Street would operate as a transit mall with a surface station between Rogers and Charles Streets. At Thorndike the line would re-enter a subway and continue beneath the area now occupied by Lechmere Station, cross the O'Brien Highway, and continue beneath the relocated Lechmere Station. Interface with the Green Line would at occur at a new subway station beneath Lechmere.

From Lechmere the line would rise to the surface and then to aerial structure parallel to and at the approximate elevation of the Gilmore Bridge. The surface portion of the line just north of Lechmere Station would also provide turnouts where Circumferential Line light rail trains could access the proposed new Green Line yards and shops. Circumferential Line light rail equipment would be stored and maintained here. A new station would be built above the existing Community College Station on the Orange Line. Commuter rail access would be provided by new platforms adjacent to the Orange Line platform.

4. Alternative 3D - JFK/U Mass Core LRT

This alternative includes the core alignment of alternative 3C and adds an extension from Ruggles Station to the JFK/U Mass Station on the Red Line as illustrated in Figure VII-13. This extension produces a total double-track line length of [illegible] miles. The total number of stations would increase to 14, with four at-grade, two on aerial structure and eight in subway. New commuter rail platforms would added near St. Mary's Street on the Framingham Line, at Community College on all North Station lines, and at JFK/U Mass on the Old Colony Line. Light rail vehicle storage and maintenance would be accommodated at an expanded facility at Lechmere.

Because of the line's greater length and the lower rider demand on the outer portions, two light rail lines would be operated. One would run from JFK/U Mass to Kendall Square, and one would connect Ruggles Station to Community College. In the highest demand segment between Ruggles and Kendall the lines would be concurrent giving a high level of service.

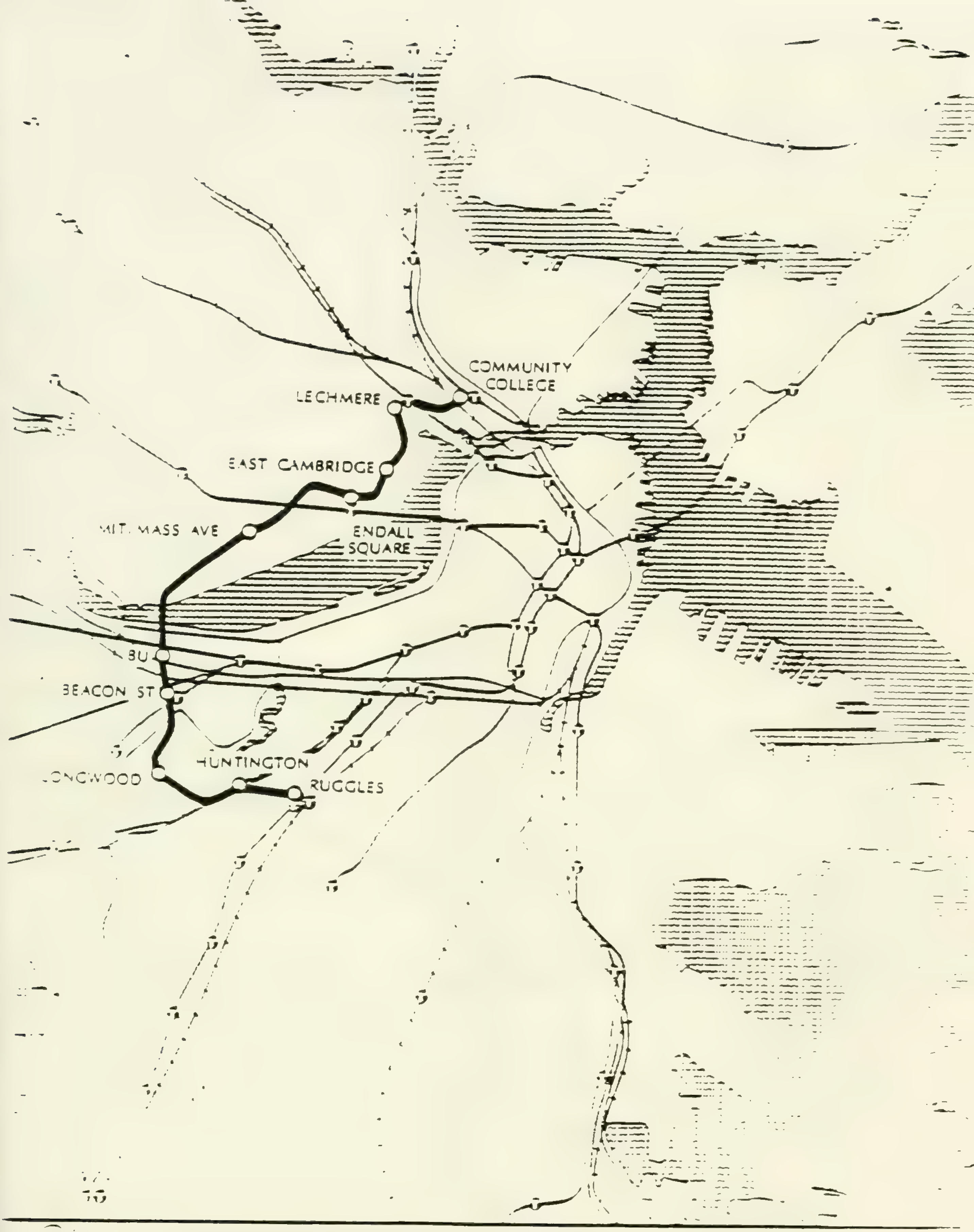
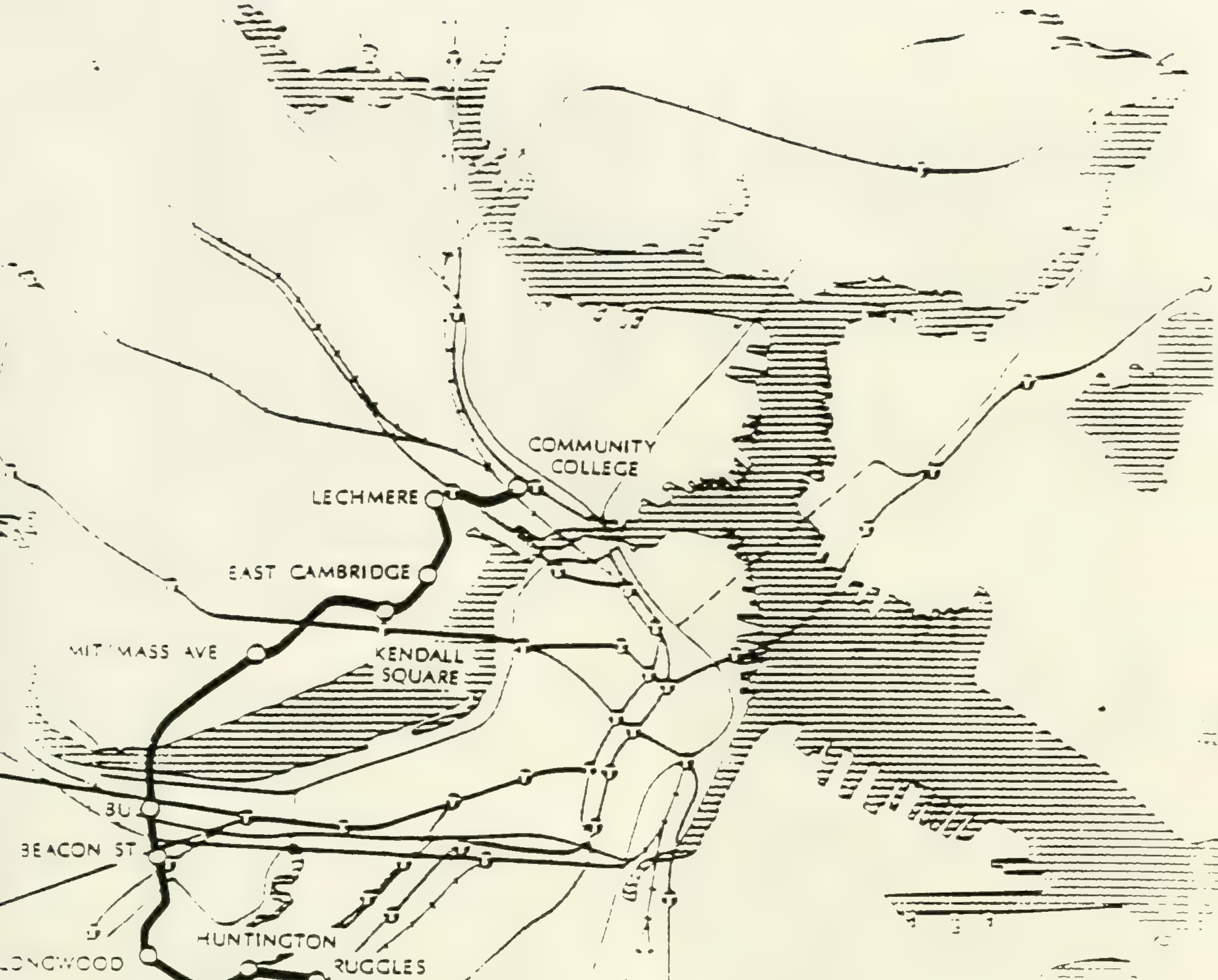


FIGURE VII-12
Alternative 3C : Core LRT



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VII-13

Alternative 3D : JFK / U Mass Core Alignment

Corridor development from Ruggles Station to Community College would be the same as that described for Alternative 3C. The segment from Ruggles Station to JFK/U Mass Station would proceed on a surface alignment in the median of a widened Melnea Cass Boulevard from Tremont Avenue to approximately Morrison Avenue. The widening would utilize the existing transit reservation. The median treatment would be similar to the existing Green Line B Branch on Commonwealth Avenue. A single side platform station would be located in the median of Melnea Cass Boulevard at Washington Street. At approximately Morrison Avenue the line would enter a subway section running under Albany Street and then down Massachusetts Avenue. The line would then surface again in the median of a widened Massachusetts Avenue at approximately Magazine Street. A single station would be located in the subway segment between Albany and Southampton Streets. A pedestrian mezzanine level would connect to Boston City Hospital.

The alignment would continue in the median of Massachusetts Avenue with side platform stations located at Magazine Street in the Newmarket area and near the intersection of Boston Street and Columbia Road to serve the area around Edward Everett Square. The line would continue in the median of Columbia Road to a point near Dorchester Avenue where it would rise on an aerial structure, cross over the Southeast Expressway and curve south to a new station above the existing Red Line platforms. The JFK/U Mass Station would be on a viaduct, with vertical circulation provided between the Circumferential Line at the top level, the Red Line at the middle level, and a commuter rail platform at the ground level.

5. Alternative 3E - JFK/U Mass to Airport via Community College

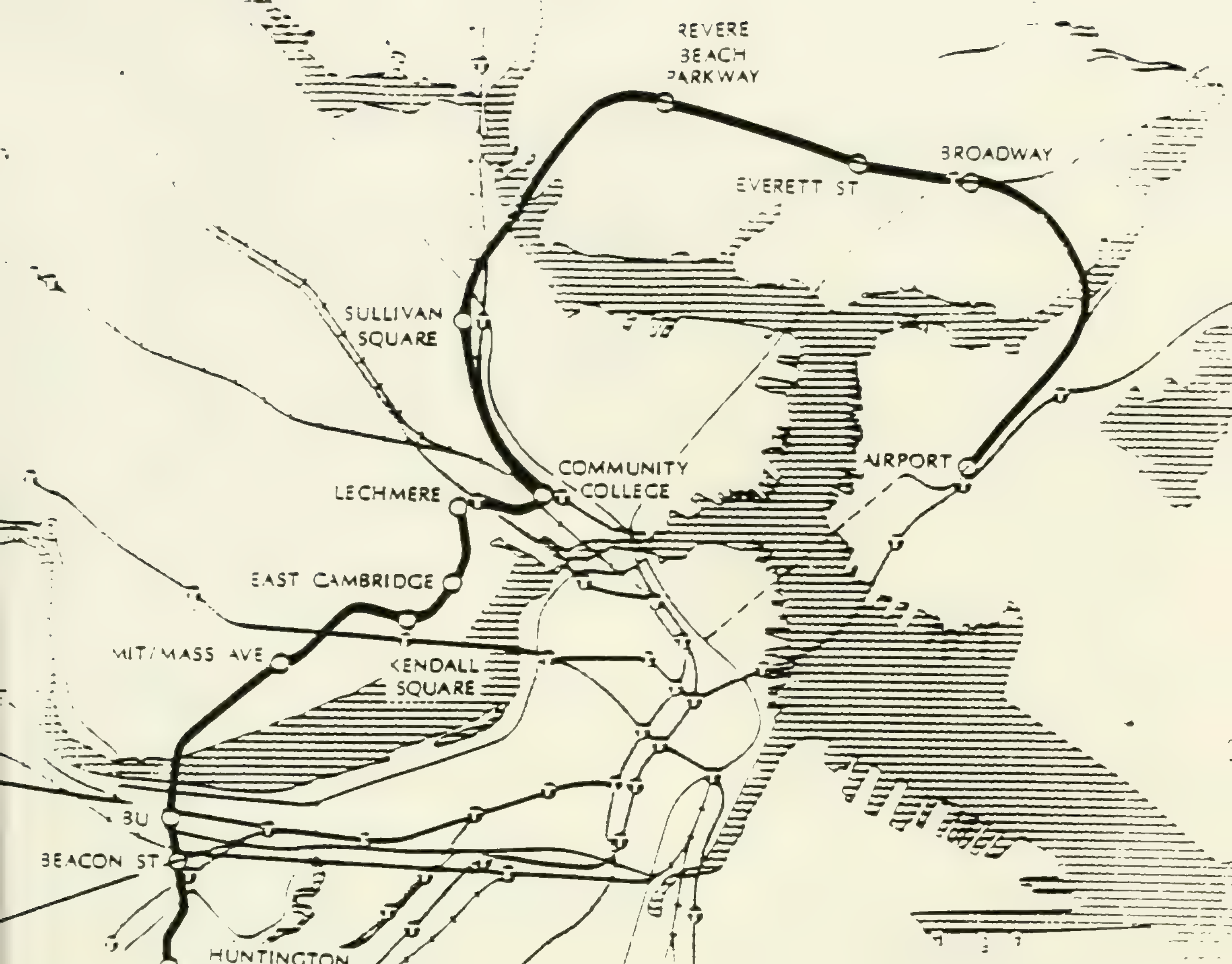
This alternative would provide light rail service the full length of the corridor from JFK/U Mass to Logan Airport. It would be essentially the same as Alternative 3D from JFK/U Mass to Community College. From Community College Station on the Orange this alternative would extend circumferential service north along existing rail facilities through Somerville, Everett, and Chelsea, then southward to East Boston and terminate at Logan Airport, as illustrated in Figure VII-14. This alternative consists of a total of 13.3 double track miles, with nearly all of the additional six miles compared to Alternative 3D being at-grade. The total number of stations would increase to 19 with nine at-grade, two on aerial structure, and eight in subway. New commuter rail platforms would be developed near St. Mary's Street on the Framingham Line, at Community College on all North Station Lines, and at JFK/U Mass on the Old Colony Line. Light rail vehicle storage and maintenance would be accommodated at an expanded facility at Lechmere.

Because of the length of the route three light rail lines would be operated. One would serve the entire corridor from JFK/U Mass to Logan Airport. A second would operate between JFK/U Mass and Kendall. And a third would connect Ruggles Station to Community College Station.

The alignment, right-of-way development, and station locations between JFK/U Mass and Community College would be the same as those described for Alternative 3D. From Community College Station the line would extend to Sullivan Square paralleling the Orange Line. This segment would involve at-grade, retained fill, and aerial structure segments. An at-grade side platform station would be built at Sullivan Square.

From Sullivan Square the Circumferential Line would pass over the Orange Line and commuter rail lines and return to grade on the MBTA's Eastern Route between Reading Junction and the Mystic River. A new bridge would be required for the Mystic River crossing. From the Mystic River to the vicinity of Broadway in Chelsea the Circumferential Line would be adjacent to and to the south of the Eastern Route. From Broadway in Chelsea to the Chelsea River, the Circumferential Line would follow an abandoned portion of the Conrail Grand Junction right-of-way. At the Chelsea River a new bridge would be required. Beyond Sullivan Square three at-grade, side-platform stations would be developed at the intersection of the Revere Beach Parkway and Broadway in Everett, Everett Avenue in Chelsea, and Broadway Avenue in Chelsea.

From the new bridge across the Chelsea River the line would continue south using the existing Conrail and Boston and Maine rights-of-way to a point adjacent to the existing Airport Station on the Blue Line. Here, a terminal station would be constructed with direct pedestrian access to the Blue Line and intra-airport transit services.



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VII-14

Alternative 3E : LRT

JFK / U Mass to Airport via Community College

6. Alternative 3F - JFK/U Mass to Airport via Grand Junction

This alternative would provide light rail service the length of the corridor from JFK/U Mass to Logan Airport, using a slightly different alignment than that described for Alternative 3E. Under this option the Grand Junction Railroad would be utilized for its entire length from the Charles River to Sullivan Square Station on the Orange Line, as illustrated in Figure VII-15. This modified alignment consists of 12.7 double track miles. A total of 18 stations would be included, nine at-grade, two on aerial structure, and seven in subway. New commuter rail platforms would be constructed near St. Mary's Street on the Framingham Line, near the O'Brien Highway on the Fitchburg Line, at Sullivan Square on the North Shore, Lowell and Haverhill Lines, and at JFK/U Mass on the Old Colony Line. Light rail vehicle maintenance and storage would occur at an expanded facility at Lechmere.

As with Alternative 3E, three different routes would serve the corridor. One route would run the entire corridor from JFK/U Mass to Logan Airport. One would provide service between Ruggles Station and Sullivan Square Station. And one would connect JFK/U Mass Station to Main Street in Cambridge.

The alignments from JFK/U Mass to Main Street in Cambridge and between Sullivan Square Station and Logan Airport would be identical to those described for Alternative 3E. Between Main Street in Cambridge and Sullivan Square, however, this alternative would follow the alignment of the Grand Junction Railway. Unlike the other light rail options it would not pass through Kendall Square. Instead a subway station would be built near Broadway and Vasser Street and a shuttle bus connection would be provided from here to the Red Line Station at Kendall Square. After passing below Binney Street the line would rise from subway to grade and continue at-grade in the Grand Junction right-of-way to the O'Brien Highway. One surface side-platform station would be developed in this segment near Cambridge Street.

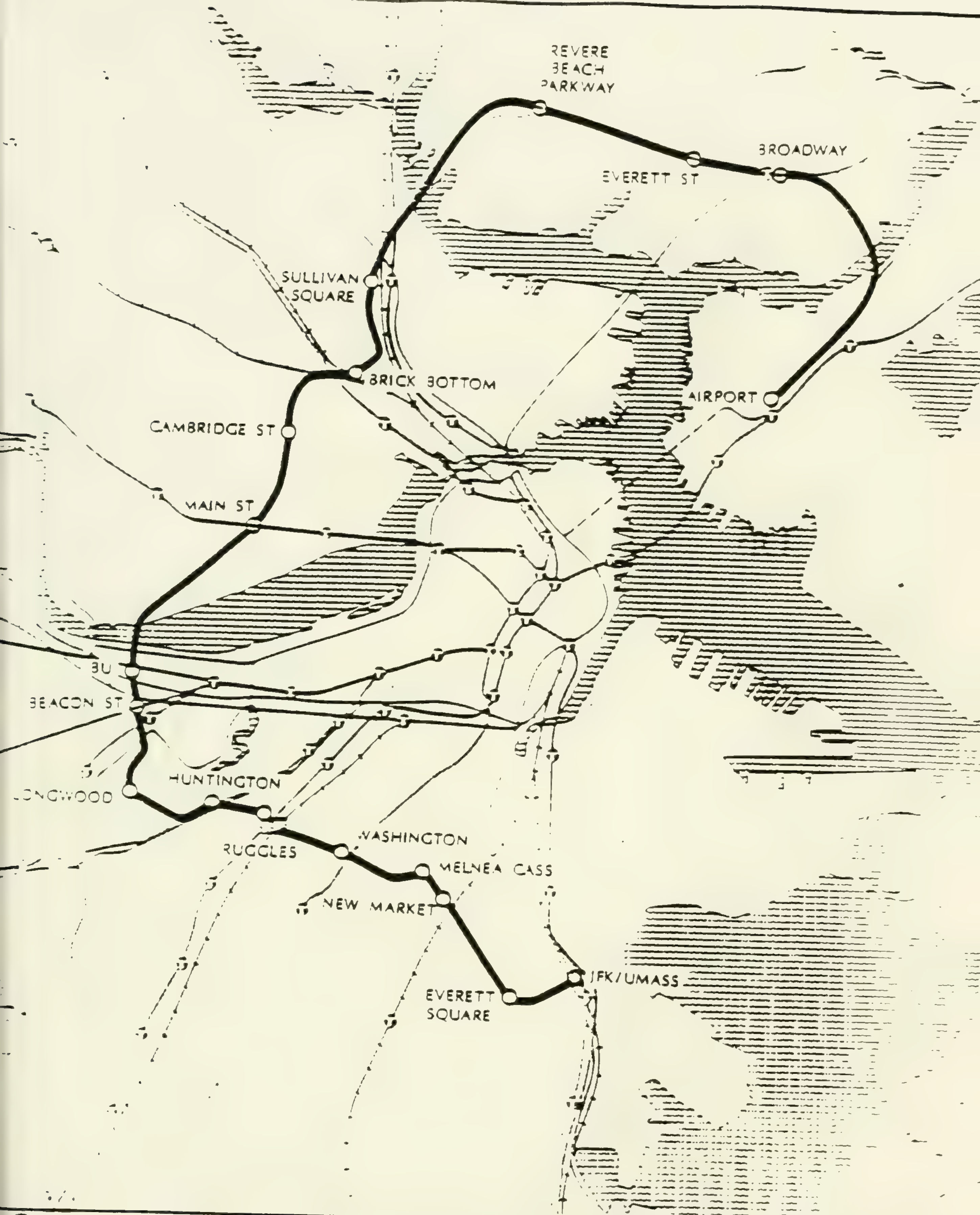
From the O'Brien Highway to Sullivan Square the Circumferential Line would traverse an area that was formerly all railroad yards but is gradually seeing development in other uses. The line would remain almost entirely within the Conrail Grand Junction Railroad, sharing the right-of-way with freight operations. In the Brickbottom area of Somerville, the Circumferential Line would rise on an aerial structure, and cross over the Fitchburg commuter rail line. A station would be constructed on this elevated segment, with direct connections to both a new at-grade station on the Fitchburg Line and a station on the extended Green Line. The Circumferential Line would return to grade and continue to an at-grade station at Sullivan Square. From Sullivan Square to Logan Airport the alignment would be the same as Alternative 3E.

7. Alternative 5D - Mini Metro Core Alignment

The earlier analysis of fully grade separated medium capacity rapid transit options indicated that only the central portion of the corridor had potential year 2010 ridership large enough to warrant this high capital cost alternative. As a result, the detailed analysis was limited to an alternative running from Ruggles Station to Community College Station, as illustrated in Figure VII-16. The line would consist of approximately 5.1 miles of double-track guideway, all in subway except for a limited section between Lechmere and Community College. A total of ten stations would be constructed, one on aerial structure, and nine in subway. Also included is a new maintenance and storage facility north of Community College Station, and new commuter rail platforms on the Framingham Line near St. Mary's Street and on all North Station lines at Community College. The mini metro alternative would operate as a single line running from end to end of the core corridor.

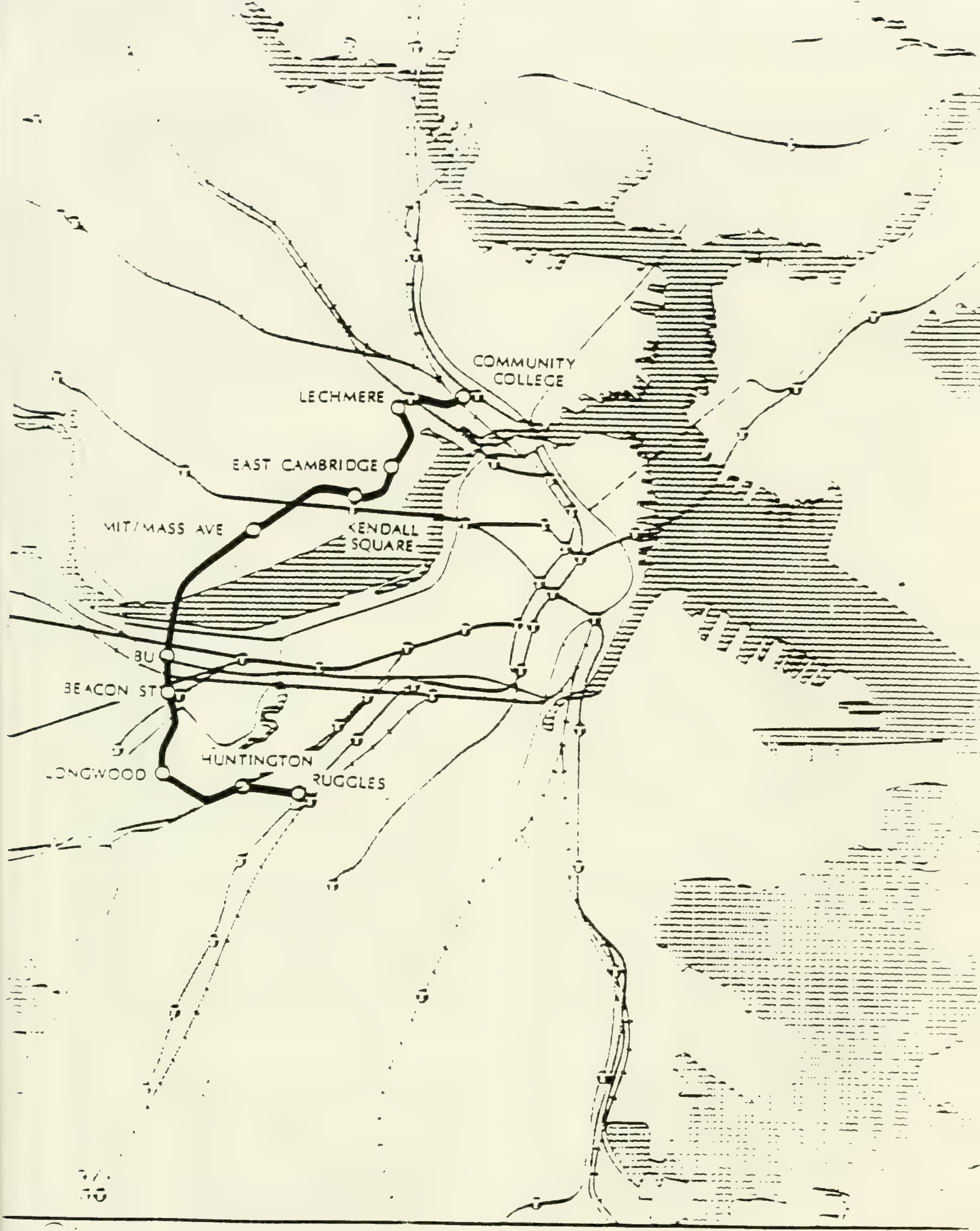
The line would begin at a station located beneath the Ruggles Orange Line and commuter rail station and continue in subway along the Ruggles Street transit easement to Huntington Avenue. From here the subway would continue on an alignment under Huntington Avenue, Longwood Avenue, Brookline Street, and Park Drive through the Longwood area crossing all four branches of the Green Line and passing beneath the Charles River just east of the Boston University Bridge. Stations would be located beneath Huntington Avenue near Longwood Avenue, with direct E Branch connections; beneath Longwood Avenue at Binney Street; beneath Park Drive between Medfield and Beacon Streets, with direct D Branch access from the existing Fenway Station and C Branch access provided by a new Green Line Station beneath Beacon Street at Park Drive; and beneath the Boston University Campus at approximately St. Mary's and Babbit Streets, with direct Framingham commuter rail line access from a new platform adjacent to the Turnpike and B Branch access at Commonwealth Avenue.

Once across the Charles River to Cambridge the line would continue in subway beneath the Grand Junction Railroad to Main Street. A station would



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VII-15
Alternative 3F : LRT
JFK / U Mass to Airport via Grand Junction



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VII-16

Alternative 5D : Mini Metro Core Alignment

be located at Massachusetts Avenue providing access to MIT and the University Park area. The subway would continue down Broadway to a new Kendall Square Station near Third Street. A pedestrian tunnel would connect the Circumferential Line platform to the Red Line.

From Kendall the subway would continue around the Badger Building and intersect Second Street at Athenaeum Street. From here the subway would continue beneath Second Street and through the area now occupied by Lechmere Station, cross the O'Brien Highway, and continue beneath the relocated Lechmere Station. Interface with the Green Line would occur at a new subway station beneath Lechmere.

From Lechmere the line would rise to the surface and then to aerial structure parallel to and at the approximate elevation of the Gilmore Bridge. A new station would be built above the existing Community College Station on the Orange Line. Commuter rail access would be provided by new platforms adjacent to the Orange Line platform. The line would ramp to ground level beyond Community College Station parallel to the Orange Line, where the mini metro system's maintenance and storage facilities would be developed.

8. Alternative 6 - Guided Bus

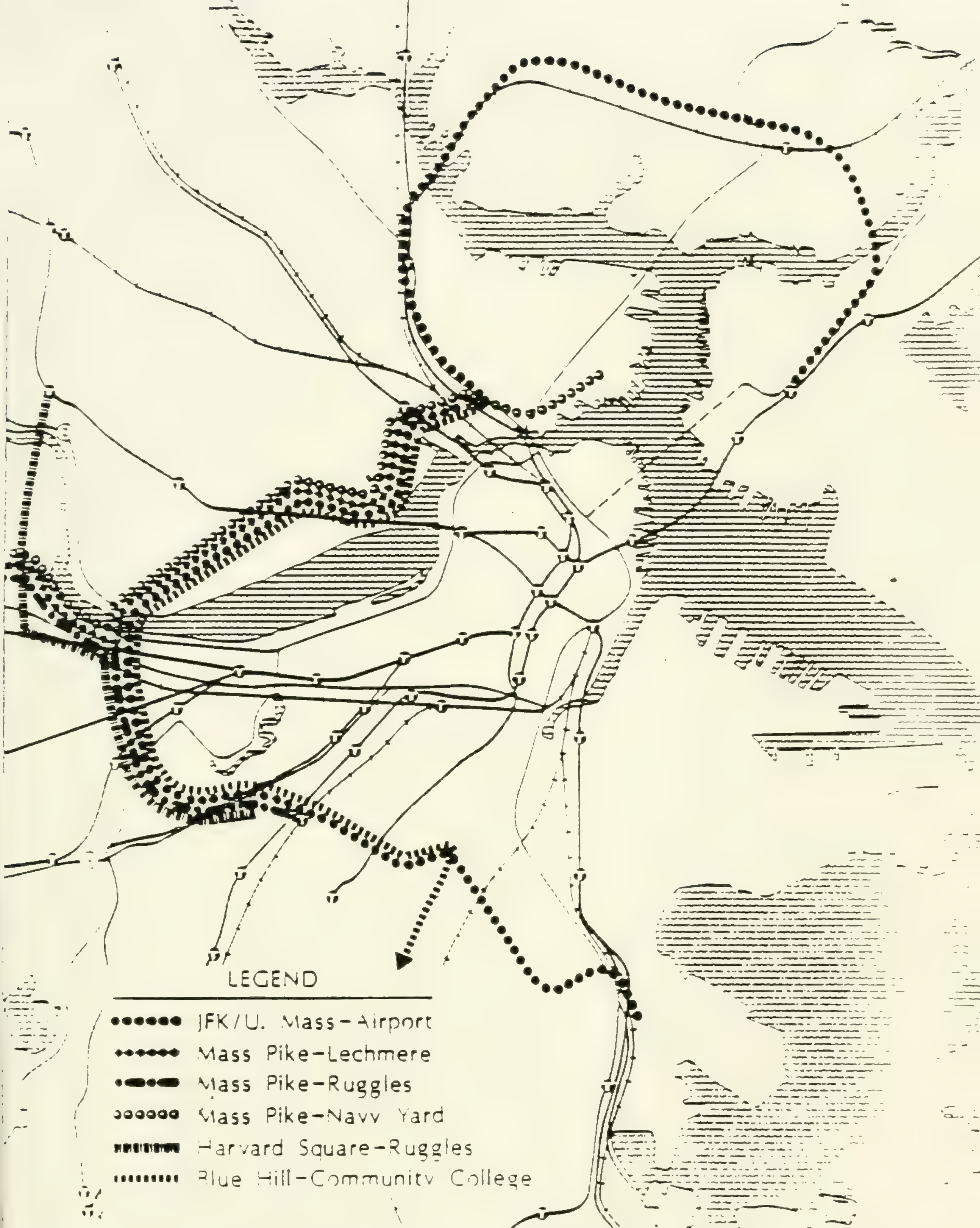
The initial right-of-way analysis concluded that opportunities for low cost guided bus development were very limited in the core segment of the circumferential corridor between Ruggles Station and Community College Station. Between Ruggles Station and the Charles River in Boston and Brookline little or no right-of-way exists. In Cambridge, joint operation of guided buses and rail vehicles along the Grand Junction Railroad between the Charles River and Main Street appears infeasible. However, outside the core area significant opportunities exist for guided bus development on both the extensions to JFK/U Mass from Ruggles and Logan Airport from Community College.

Thus, the core part of the corridor requires significant subway construction, similar to that identified for the light rail and mini metro alternatives, if guided buses are to have a significant advantage over mixed traffic, conventional bus operation. For purposes of analysis the guided bus alternative was defined with guideway development throughout the length of the corridor from JFK/U Mass to Logan Airport. Therefore, it is similar to the light rail system described in Alternative 3E. The added flexibility of the bus operation, however, allows the addition of extensions from the primary corridor to activity centers such as the Charlestown Navy Yard and the airline terminals at Logan Airport as well as service connections to radial corridors such as the Massachusetts Turnpike.

A total of 13.3 double track guideway miles would be included, with over four miles of subway, limited sections on aerial structure, and the balance at grade. A total of 19 stations would be included with nine at-grade, two on aerial structure, and eight in subway. New commuter rail platforms would be developed near St. Mary's Street on the Framingham Line, at Community College on all North Station Lines, and at JFK/U Mass on the Old Colony Line. Guided bus vehicle storage and maintenance was assumed to be accommodated by expansion of existing MBTA bus bases.

Six separate bus routes would operate in the corridor, as illustrated in Figure VII-17. One route would traverse the entire corridor from the JFK/U Mass Station to Logan Airport. Three lines would travel along the Massachusetts Turnpike from Route 128 to three points on the corridor: Ruggles on the new Orange Line, Lechmere on the Green Line, and the Charlestown Navy Yard via Community College Station. A fifth route would connect Ruggles Station to Harvard Square via the Circumferential Line and surface streets in Cambridge. A sixth route would operate along Blue Hill Avenue from Route 128 to the Circumferential Line, then continue along the entire line in Boston and Cambridge, terminating at the Community College Station on the Orange Line.

From JFK/U Mass Station on the Red Line to Airport Station on the Blue Line guideway development and station locations would be the same as those described for Alternative 3E and illustrated in Figure VII-14. Additional corridor access would be provided to allow vehicles to enter and exit the guideway where the alignment crosses the Massachusetts Turnpike near the Boston University Bridge, at Community College Station on the Orange Line, at Logan Airport, and at intersections along the surface segments between Ruggles and JFK/U Mass Stations and Sullivan Square Station and the Chelsea River Bridge. With the exception of the Turnpike connection, all of these would be relatively simple to develop. The former would require a complex and extremely expensive series of ramps, many in tunnel sections, near the Boston University Bridge.



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VII-17
Alternative 6 : Guided Bus

VIII. LAND USE AND ENVIRONMENTAL IMPLICATIONS

This chapter summarizes the findings of the land use and environmental analysis of the potential implications of development of a fixed transit facility in the circumferential corridor. Because of the nature of the corridor, its existing dense development and current rapid redevelopment, land use and land use implications are critical to decisions about the appropriateness of a major capital investment to connect activities in the corridor.

As a result, a two phase study was undertaken. The initial phase emphasized a broad brush survey of potential corridor alignments to identify land use characteristics and development opportunities and constraints. The second phase focused on critical areas within selected corridor segments to examine issues of land-taking, neighborhood impact, and land use change. Also included were the identification of potential environmental impacts including wetlands, parks, historic areas, and sensitive air and noise receptors. In the second phase study individual corridor segments, corresponding to those used for the alternative route analyses, were studied in detail to assess more specifically system impact, land taking and land use issues.

A. CORRIDOR LAND USE ANALYSIS

This section provides an overview of existing land use in the circumferential transit corridor. The overview is helpful in identifying area-wide patterns, locating pockets of decline or use transition and noting areas with high redevelopment or growth potential. This information was used to assess initial route alternatives and evaluate system options. The analysis also identified areas of special urban or natural environmental sensitivity recommended for further detailed study.

The corridor analysis was limited to a generalized overview of existing and developing land use along the proposed alignment. A more detailed analysis of opportunities and constraints is contained in the individual segment discussions which follow

Figure VIII-1 illustrates general land use in the corridor as compiled from the zoning maps of the political jurisdictions affected. This information is presented in a general form with minor use areas and corridor edges omitted for simplification and facilitation of small scale reproduction.

The proposed circumferential transit corridor connects existing centers of high activity as well as emerging redevelopment districts of more uncertain future. It links educational and cultural institutions of regional and national importance, passes through pockets of industrial and urban decay, and traverses residential districts of every economic level. The alignment is typified by its diversity and is a natural product of both its mission and placement across a series of radial transit corridors. The effect of this diversity of land use and economic level is that not all segments of the circumferential route can be expected to benefit equally from its development. Major educational and cultural institutions, high technology concentrations and business districts can expect to benefit from improved access for customers, students, or staff. Emerging activity districts, such as the New Market Industrial District along Massachusetts Avenue may benefit even more. Public housing developments such as those in Boston's Southwest Corridor, and underserved low cost housing areas such as those in Everett and Chelsea will benefit from easier job access for residents. But there are other areas such as the high cost residential districts south of Boston University which might resist such immediate linkage to lower economic [illegible] populations in nearby sectors.

In addition to sectorial land use patterns along [illegible] major transit radials, most of the circumferential route is also typified by a commonality of a [illegible] sort. While the circumferential pathway crosses sectors of varied use, its relatively constant distance from the core means that it also traverses a transitional zone of existing development of roughly similar age, an obvious result of the city's growth outward from its historic core. And since its distance from the core is small, its age is relatively old, most of its development occurring in the [illegible] years from the late eighteen to early nineteen-hundreds, a very active period in city growth

This older development has not remained [illegible] however, but has undergone [illegible] transformation of several types. All districts [illegible] seen in relation to this. Some areas, such as along Melnea Cass Boulevard, fell into such [illegible] that they became subjects for major [illegible] interventions and renewal, and now present a [illegible]

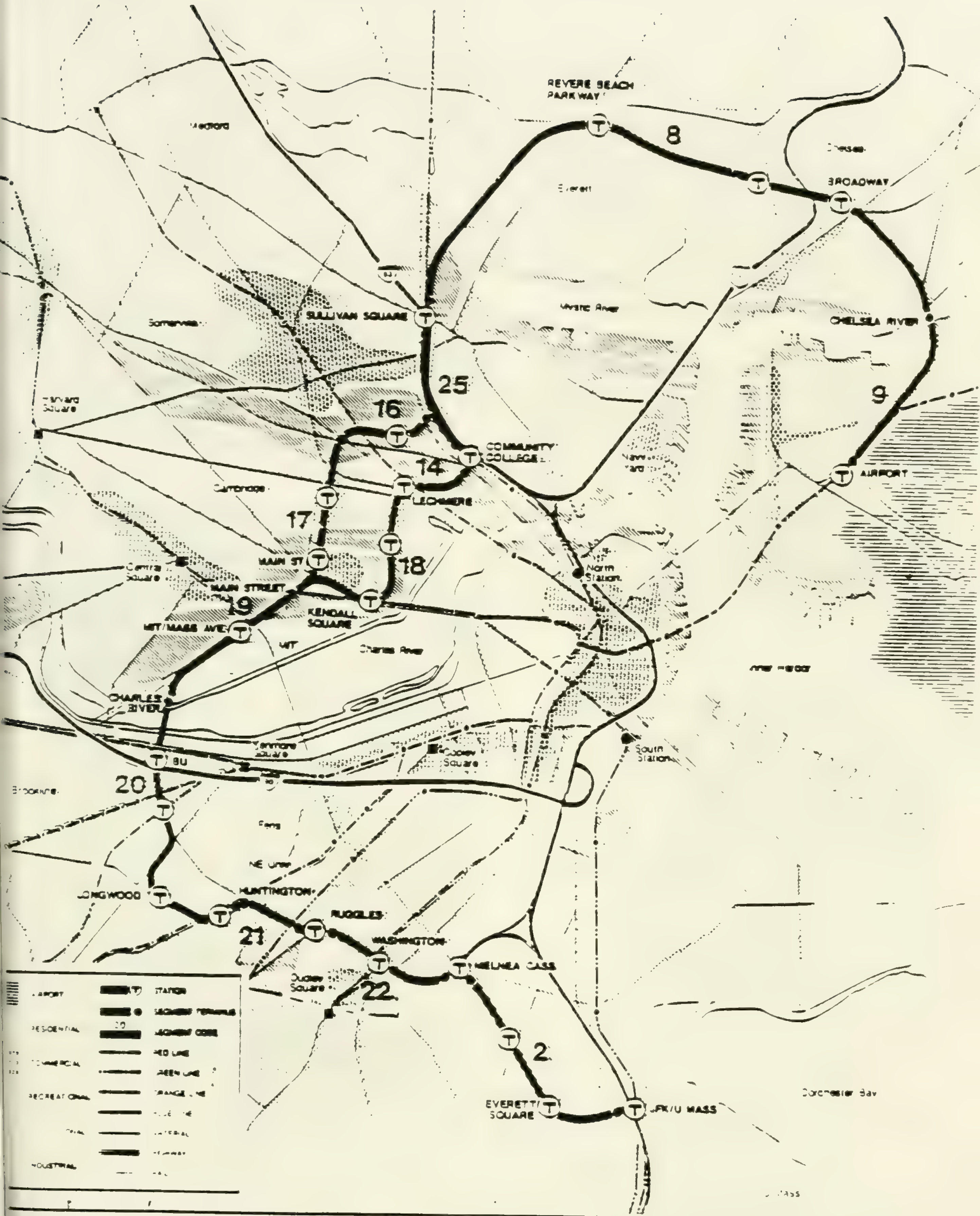


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FIGURE VIII-1
Circumferential Corridor Land Use

and different face. Other areas with a stronger economic base and greater adaptability such as the Longwood Medical Area and Kendall Square, have undergone an incremental and largely private regeneration process and now offer a mix of old and new. Still other areas such as the decaying industrial and housing areas bordering the Mystic River in Everett and Chelsea, remain overlooked pockets of the region which might benefit greatly from the catalyst of improved public transit access.

The circumferential system crosses bunched radial transit systems of differing type at several points, such as Lechmere - Community College, to create potentially significant new transportation hubs, candidates for development similar to that now occurring at the Alewife hub in Cambridge. These potentials should be recognized and studied in future stages of circumferential analysis.

B. OPPORTUNITIES AND CONSTRAINTS

Analysis of opportunities and constraints was undertaken on a segment by segment basis, and included the investigation of the impacts of alternative routes in a number of locations. Findings for each segment with respect to context, zoning, development, condition, constraints, and potentials are summarized later in this chapter and were used as key inputs to the refinement of alternative alignments.

In addition to the specific segment findings, there are some generalized comments which can be made. The nature of the route selection process, with its give and take, has resulted in alignments with relatively few conflicts. The process identified areas, such as the Longwood Medical Area, Kendall Square, East Cambridge, Lechmere, and areas of Everett and Chelsea which need more detailed urban design study.

There are, of course, also conflicts worthy of further consideration. For example, improved access in areas such as Longwood, may generate additional development rather than reduce congestion in an already overcrowded area; and improved access to the Mystic River shoreline may induce high cost waterfront development and gentrification rather than improve job access for present low income residents. On the whole, however, there are surprisingly few negatives and many positives for a project of this magnitude.

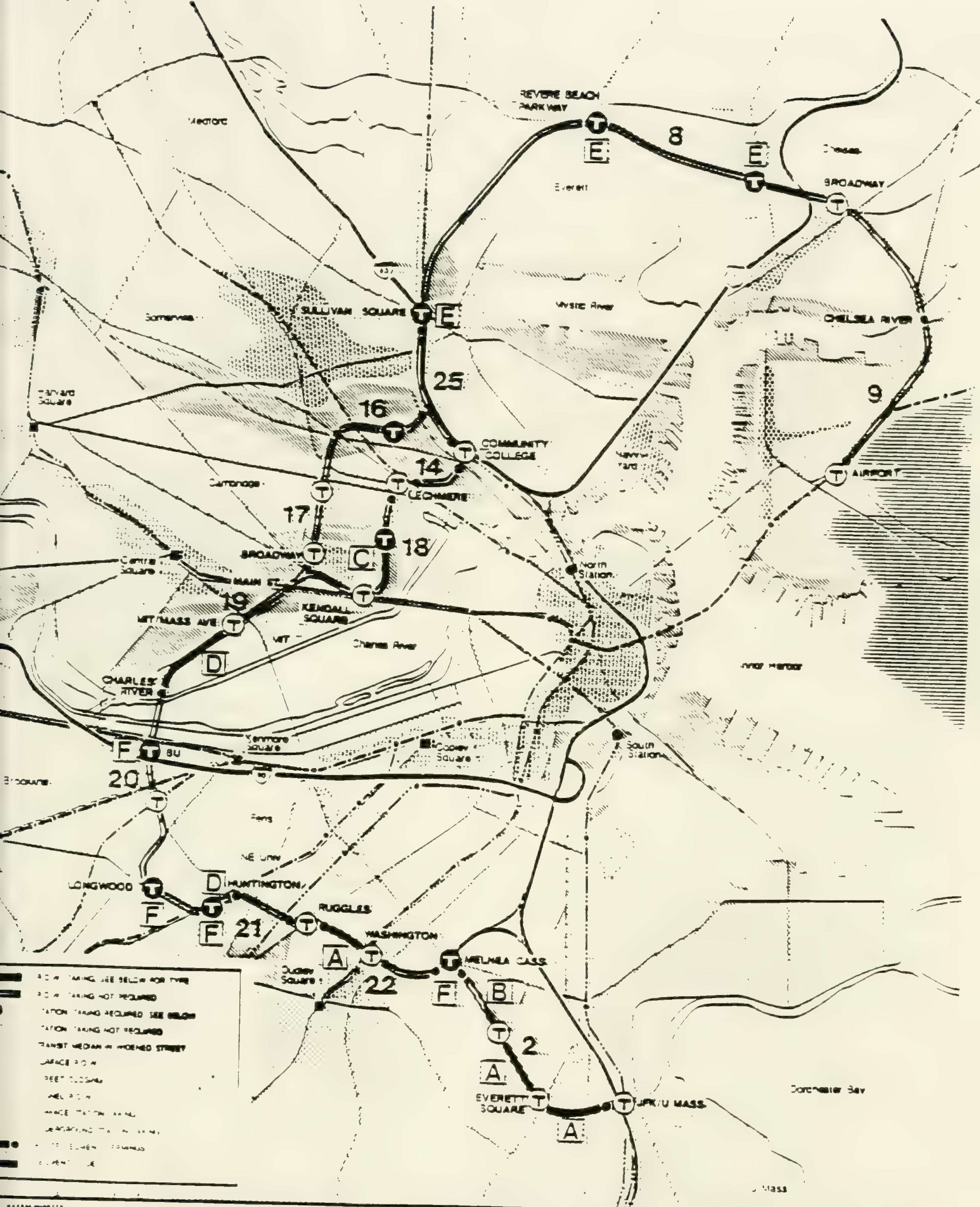
C. LAND TAKINGS

This analysis identified and mapped areas where significant right-of-way acquisition might be required, which might adversely affect route and system feasibility. Potential takings were identified through field observation and alternative alignment studies. These findings were then developed into preliminary route mappings and converted for symbolic presentation on the maps shown in Figures VIII-2 and VIII-3 for the family of alternatives involving light rail and guided bus and mini metro options.

Land takings required are not extensive since considerable effort was taken to identify routes for which takings would be minimal. Takings for the light rail or guided bus system south of the Charles River are primarily for underground stations and street widening for transit medians, while takings north of the Charles River are for below grade right-of-way (Grand Junction Railroad) and grade level stations. Nearly all of the route north of the Charles River follows existing railroad right-of-way. Takings for the mini metro alternative are even fewer, since the route is shorter and nearly all in subway below public streets and existing rail right-of-way.

D. SEGMENT BY SEGMENT ANALYSIS

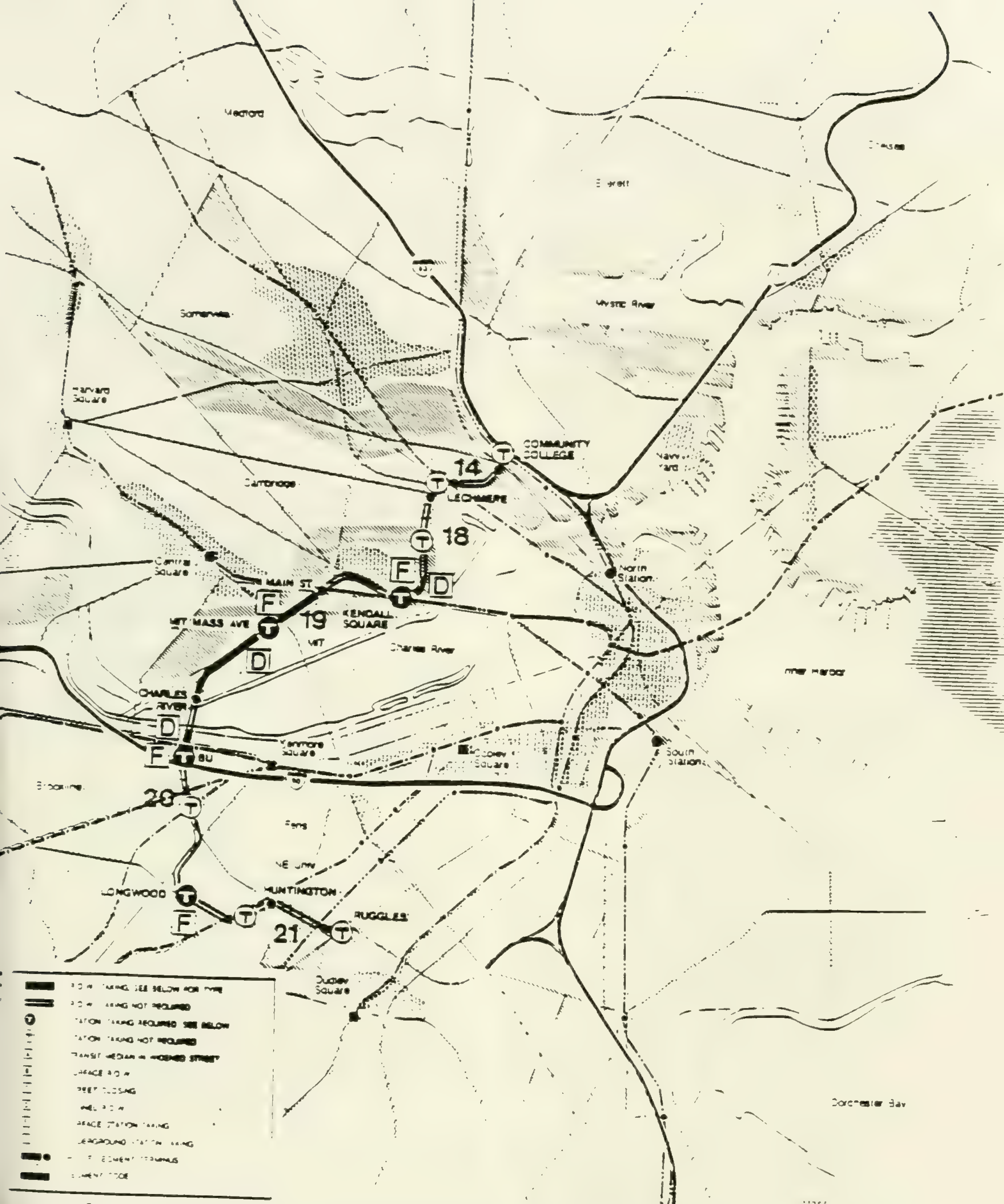
The following sections summarize the findings of the segment by segment land use analysis. For each segment, the current land use context, existing zoning, current and future development, general area condition, constraints to transit development and potentials related to transit development are identified and discussed.



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VIII-2

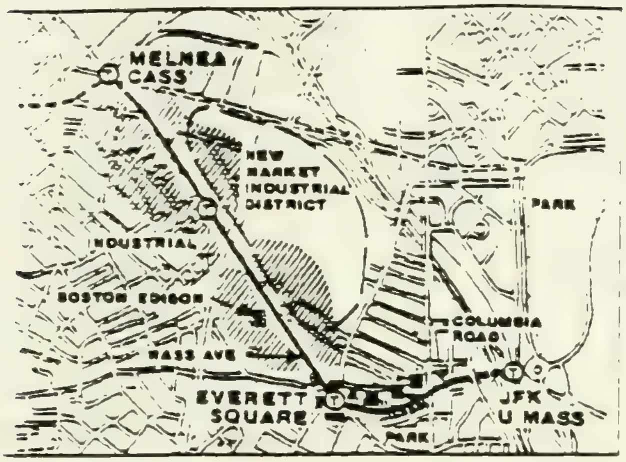
Land Takings - LRT & Guided Bus Alternatives



CIRCUMFERENTIAL TRANSIT FEASIBILITY STUDY

FIGURE VIII-3
Mini Metro Land Takings

1. JFK/U Mass to Melnea Cass Boulevard



This segment begins at the new JFK/U Mass Station immediately east of the Southeast Expressway (I-93). It continues west along Columbia Road to Edward Everett Square where it joins Massachusetts Avenue to the intersection with Melnea Cass Boulevard. Stations would be located at JFK/U Mass, Edward Everett Square, in the Newmarket area, and at Melnea Cass Boulevard.

- **Context** - the segment divides into two sections of markedly different characteristics. It passes first through an established older neighborhood, then beyond Edward Everett Square it enters a redeveloping industrial district. The neighborhood, which encompasses the Columbia Road leg of the segment, is typified by well maintained three decker residences and significant institutional uses, including two schools and St. Margaret's Church. A small park to the south introduces the Square, a thriving neighborhood convenience center. The industrial district extends along the Massachusetts Avenue leg of the segment and is a mix of warehousing, light industrial, and automotive service businesses. To the south is a major service center for Boston Edison, and to the north the New Market Industrial District which contains new and redeveloped buildings. New uses also include City offices. Continuing development and increasing employment can be expected to increase ridership in the future.

- **Zoning** - is primarily multi-family residential along Columbia Road, light manufacturing at the Southeast Expressway, business at Edward Everett Square, and light manufacturing south of Massachusetts Avenue in the New Market Industrial District.

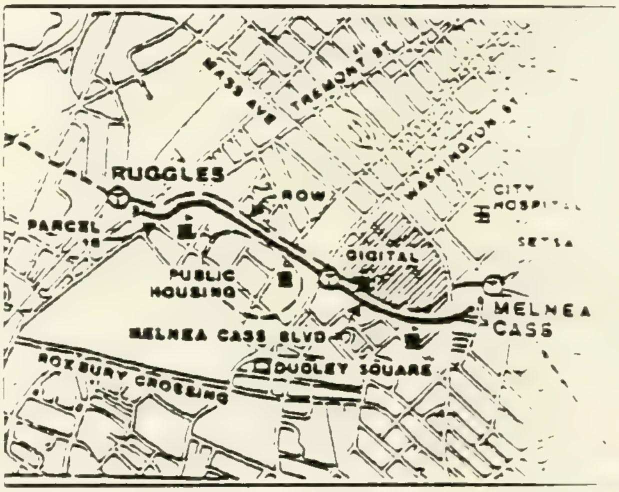
- **Development** - continued industrial development is forecast in the district, with some spill-over south of Massachusetts Avenue. The residential district along Columbia Road appears stable and mature with little change likely.

- **Condition** - properties are generally well maintained.

- **Constraints** - elevated transit systems on Columbia Road or through Edward Everett Square would have a negative impact on residential and educational uses. Of specific concern would be the awkward transition from elevated to surface placement. While there would be little negative impact on the Massachusetts Avenue leg for elevated placement, surface placement throughout the segment would minimize visual impact.

- **Potentials** - the intermediate stations in both the New Market area and at Edward Everett Square could have a positive impact on service businesses, partly from New Market Industrial District employee transit use. The latter would also improve transit system access for Dorchester residents.

2. Melnea Cass Boulevard to Ruggles Station



This segment begins at the Melnea Cass Boulevard/Massachusetts Avenue intersection, continues on Massachusetts Avenue and [illegible] Street to a right-of-way reservation within Melnea Cass Boulevard and on to Ruggles Station at Tremont and Ruggles Streets. A subway [illegible] would be located under Massachusetts Avenue between Albany Street and Melnea Cass Boulevard and an intermediate surface station would [illegible] located on Melnea Cass at Washington Street

- **Context** - the area is typified by comparatively recent large scale redevelopment in the form of institutional uses around the Boston University Medical Center and Boston City Hospital, industrial facilities, and large multi-family public housing projects. Industrial development east of Washington Street includes Stride-Rite, Boston Body Works, and a major Digital plant. Public housing, west of Washington Street and to the south is recent and varied. To the north a major renewal program has recently been initiated. Housing to the south forms the northern edge of Roxbury Crossing.

- **Zoning** - is light manufacturing from Massachusetts Avenue to Washington Street, where it changes to business; and multi-family residential from Washington Street to Ruggles Station.

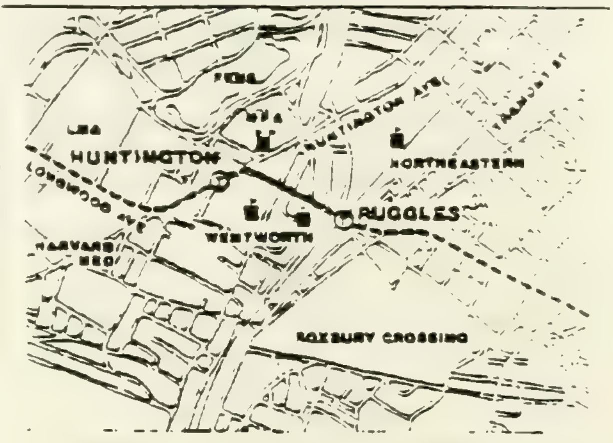
- **Development** - the area has been redeveloped to accommodate the automobile, with more suburban than urban characteristics, especially the sense of isolated projects segregated by intervening open space. Parcel 18 at Ruggles Station offers an opportunity to develop an urban core as a focus for the area. Southeast Technology Square (SETSA) plans a major complex on Albany Street near the Boston University Medical Center which would include office space, a hotel, and a parking structure. It is estimated that employment in the area could double in next five years from 12,000 to 25,000.

- **Condition** - development is generally recent and in good condition, continued redevelopment of unused public housing will improve the district's image.

- **Constraints** - the frequency of intersections along Melnea Cass Boulevard could present conflicts between an at-grade median transit operation and left turning vehicles.

- **Potentials** - the new station near Albany Street should support and enhance SETSA's development plans. The intermediate station at Washington Street to interface with Orange Line replacement service could create a focus for development of the surrounding underutilized parcels. An elevated system might become a positive design element uniting the disparate development pieces typical of this segment. The abundant space provides the tolerance these systems require for comfortable fit. The development potential of Parcel 18 should be considered in connecting this segment to the Ruggles Station. Its role as an urban focus is important to district identity.

3. Ruggles Station to Huntington Avenue



This segment begins at Ruggles Station and continues northwest on Ruggles Street to Huntington Avenue where it intersects the E Branch of the Green Line.

- **Context** - the area is typified by large scale multi-family public housing developments and cultural and educational institutions with market residential infill. Institutions include Wentworth Institute and the Greek Orthodox Cathedral to the south and Northeastern University, with major surface parking to the north. The segment terminates near the Museum of Fine Arts Green Line Station on Huntington Avenue.

- **Zoning** - is predominantly multi-family residential and institutional.

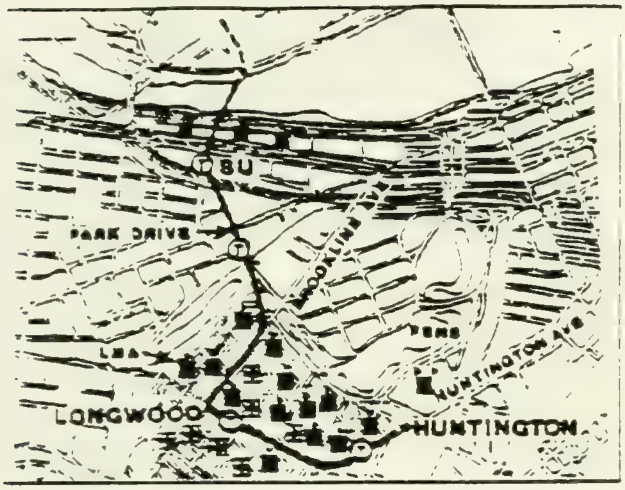
- **Development** - the area contains mature institutions and housing projects, but continued growth could lead to further development on parking (Northeastern) or open space (Wentworth) areas. The right-of-way reservation along Ruggles Street is useable for at-grade, subway or subway portal development.

- **Condition** - generally excellent, given remodeling of unoccupied public housing now in progress.

- **Constraints** - limited space exists for surface or aerial transit. The development density increases toward Huntington Avenue.

- **Potentials** - The transit right-of-way on Ruggles Street is a major asset. Emphasis in system development should be service for existing housing and the area's institutions.

4. Huntington Avenue to Charles River



This segment begins at the Ruggles Street and Huntington Avenue intersection, proceeds along Huntington Avenue to Longwood Avenue, traverses Longwood to Brookline Avenue, along Brookline to Park Drive, then passes through the Fens and Boston University, and crosses the Charles River just to the east of the Boston University Bridge.

- **Context** - the initial leg on Huntington Avenue is typical of trolley centered commuter boulevards. There is, however, a strong institutional presence with Roxbury Community College and the main campus of the Massachusetts College of Art. A retail, multi-family, and convenience cluster marks the entrance to the Longwood Medical Area, where institutional density increases and open space is more constricted. Within this area are the Massachusetts College of Pharmacy, Brigham and Women's Hospital, the Harvard Medical School, Children's Hospital, and New England Deaconess Hospital. These institutions are placed in a matrix of supporting labs, offices, institutes, retail uses, and housing. Open space is at a premium with the clear corridor between building faces along Longwood Avenue as narrow as 60 feet in places. From Longwood Avenue the corridor proceeds along Brookline Avenue, passing Simmons, Wheelock, and Emmanuel Colleges, and Beth Israel Hospital. From Park Drive the segment passes through the Fens and areas of mixed density housing, crossing the D Branch of the Green Line, and Beacon Street and the C Branch of the Green Line. From Beacon Street areas of mixed density housing and the campus of Boston University are crossed until reaching the Massachusetts Turnpike, Commonwealth Avenue and the B Branch of the Green Line. The segment then proceeds across the Charles River to Cambridge.

- **Zoning** - in the segment is primarily institutional with mixed density housing. Business zones edge most of the major arterials.

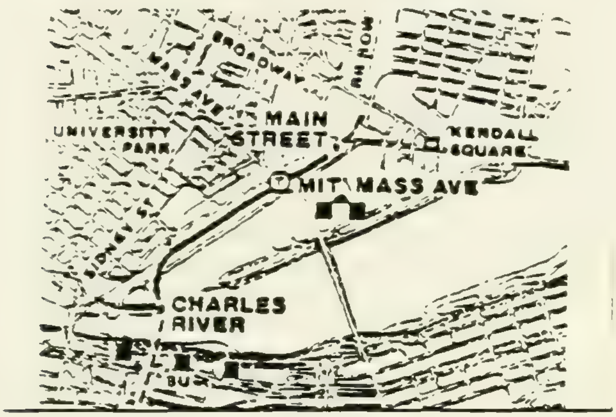
- **Development** - varies from single family and mixed density residential in Brookline and adjacent areas of Boston to the Longwood Medical area, an intensive hospital and research center. Major educational and cultural institutions are scattered throughout the segment. Further expansion of the institutions in the area is likely to continue. The redevelopment of the Sears property near Park Drive will increase activity in the area.

- **Condition** - Most housing is older, but institutions are a mix of older and ultra-modern buildings. Building conditions are generally good to excellent.

- **Constraints** - development densities, traffic congestion, and the environmental sensitivity of the area make a subway the most likely means of developing a transit facility through this segment. The impacts of right-of-way acquisition and surface or aerial construction make deep-bore grade separated systems attractive. Parklands in the Fens and along the Charles River are sensitive and will require careful consideration during design and construction. Continuation of a deep bore tunnel across the Charles River appears to be the most likely alternative. The need to interface with all four branches of the Green Line and the Framingham Line of the commuter rail system also present challenges for station development.

- **Potentials** - more important than new activities or development resulting from improved transit access may be the relief of present congestion in this highly developed area. Improved transit access is critical the area's future health and environmental quality

5. Charles River to Main Street in Cambridge



This segment begins on the north bank of Charles River, intersects and then follows the Grand Junction Railroad right-of-way in Cambridge to a station serving the University Park and MIT areas near Massachusetts Avenue, then continues on the rail right-of-way to Main Street crossing the Red Line.

- **Context** - The segment uses, or tunnels beneath, the existing Grand Junction Railroad right-of-way which is lined with typical light industrial and research and development uses.

- **Zoning** - the Grand Junction alignment is zoned industrial while University Park has been rezoned as the Cambridgeport Revitalization District.

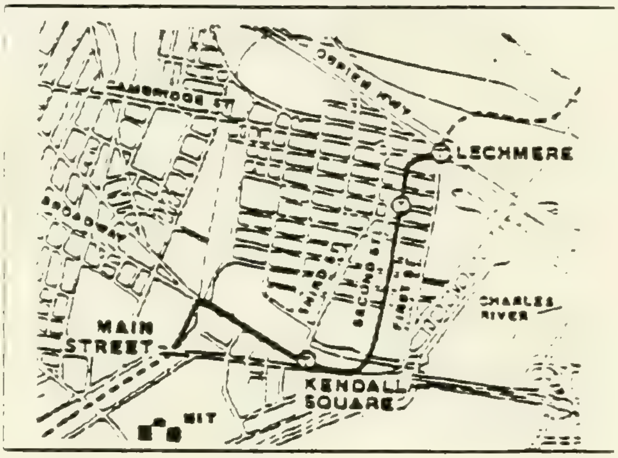
- **Development** - the Grand Junction route is edged with a mix of new, redeveloped, and existing light industrial and research and development uses. These are likely to expand given the proximity to MIT and the University Park development.

- **Condition** - existing development is mixed, from fair to good, but new facilities range from good to excellent. University Park plans a major research and technology center.

- **Constraints** - continued use of the Grand Junction for rail freight and commuter rail movements will fully utilize the surface right-of-way; thus, circumferential transit development will require tunneling beneath. This reduces somewhat the initial appeal of the right-of-way and suggests that alternative alignments, such as a subway through University Park, might be considered. However the Grand Junction route would locate the Massachusetts Avenue station conveniently close to MIT an institution not now well served by crosstown transit.

- **Potentials** - This segment can improve access to a poorly served major institution while encouraging intensive development of related research and technology uses and employment.

6. Main Street to Lechmere via Kendall Square



This segment begins at Main Street and proceeds to Broadway, turning down Broadway to Kendall Square. From Kendall Square it crosses new right-of-way to Second Street, then through the existing Lechmere Station to the new Lechmere Station north of the O'Brien Highway. Stations would be located beneath Broadway at Kendall Square, between Rogers and Charles Streets on Second Street and at the relocated Lechmere Station.

- **Context** - Broadway is a major avenue as it proceeds toward intensive new high-rise development clustered at Kendall Square. Much of the development surrounding the square consists of independent buildings placed office park fashion amidst surface parking. As the route continues up Second Street toward Lechmere development shifts to a preponderance of older buildings undergoing transformation to new high-technology uses. To the south along the Charles River new high density residential towers are being built interspersed with hotel and office uses.

- **Zoning** - areas south of Main Street are zoned industrial, with a mix of residential, PUD and business to the north. Second Street passes through PUD and industrial to a mix of industrial, PUD, and business at Lechmere

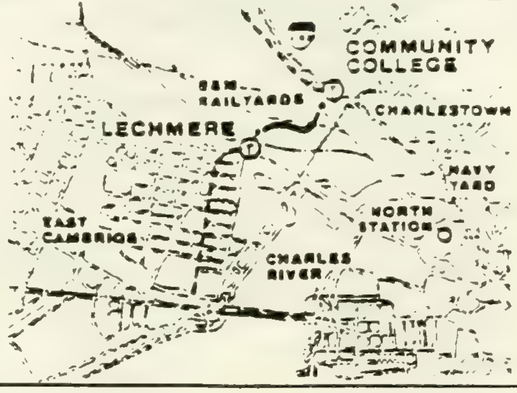
- **Development** - the Kendall Square area is in a continuing process of transformation from historic industrial and residential uses to a new mixed-use in-town research and technology center, including retail and hotel uses as well as offices. Its appearance acknowledges both its suburban office park and inner city industrial heritages, but it has yet to define a new identity or create an imageable sense of place. Lechmere and the East Cambridge area along the Charles River are also undergoing major redevelopment with uses tending toward residential, retail, hotel and some office.

- **Condition** - varies from first class new high-rise construction along Main Street and Broadway through Kendall Square and along the Charles River to restored or still dilapidated older structures on the approaches to Lechmere.

- **Constraints** - interface with the Red Line is important at Kendall Square; however, this could require complex and expensive below grade pedestrian connections between the passenger platforms of the two systems. Both at-grade and subway alignments are possible along Second Street. With the surface alignment subway portals are required at both ends to reach Kendall Square and Lechmere. These transitions could become barriers if not carefully located and designed. Stations should be carefully located to become focal elements of a much needed comprehensive pedestrian circulation system. The closure and disruption of Second Street to traffic and access pose a serious constraint which could suggest the logic of continuing tunnel construction throughout this segment. Subsurface right-of-way must be acquired between Kendall Square and Lechmere. Attention should be given that on-going private development does not consume the existing alignment options.

- **Potentials** - The grade-level portion of this segment could become a key element and inducement for the development of an organized pedestrian circulation system in the area. Such a system could unify the disparate buildings and uses, improve access to them, and reduce the volumes of circulating traffic in the area. A pedestrian concourse at Kendall could enhance access to the Red Line from a number of points in Kendall Square.

7. Lechmere to Community College



This segment begins at the relocated Lechmere Station and provides a short connection to the Orange Line and North Station commuter rail services at Community College Station.

- **Context** - this segment crosses the historic Boston and Maine railyards on an aerial structure which rises from a subway station at Lechmere. There is no access except at the end point stations.

- **Zoning** - is industrial throughout the general area.

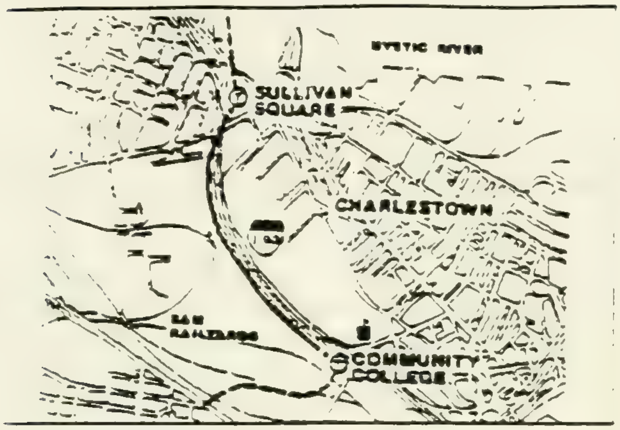
- **Development** - railyards and maintenance shops occupy most of the area. The adjacent North Point area on the Charles River is slated for mixed use redevelopment.

- **Condition** - industrial decay characterizes most of the area, which is likely to continue until land is needed for other uses.

- **Constraints** - route geometry and the need to gain access to the Lechmere maintenance facility for the light rail options will require significant right-of-way, and may limit the future redevelopment potential of the area between the two stations.

- **Potentials** - little potential exists for direct development stimulation. The segment's function is primarily to provide an extension of the route to a key interchange at Community College. Significant stimulus could occur both at the new Lechmere Station and at Community College Station.

8. Community College to Sullivan Square



This segment begins at Community College Station and follows the I-93 elevated structure to Sullivan Square Station. No stations are proposed between Community College and Sullivan Square.

- **Context** - the area is a transportation corridor edging the Boston and Maine railyards, containing I-93, the Orange Line, and commuter rail trackage. The circumferential segment would be a combination of surface and elevated. It terminates in Sullivan Square, a transportation hub with industrial and low-scale business uses.

- **Zoning** - is industrial through most of the area, with business at Sullivan Square.

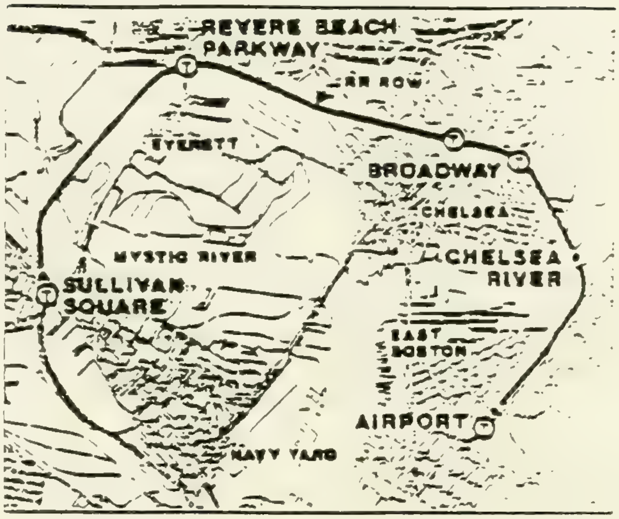
- **Development** - railyards occupy most of the area from Community College to near Sullivan Square where use changes to an industrial and business mix. Development is old and decaying with few recent improvements. The Square is primarily a transit transfer point and highway crossing rather than a shopping destination.

- **Condition** - buildings range from poor to good.

- **Constraints** - elevated rail and highway structures dominate the landscape to the detriment of other uses.

- **Potentials** - major redevelopment could occur only with removal of the railyards.

9. Sullivan Square to Logan Airport



This segment begins at Sullivan Square and runs at-grade through Everett and Chelsea along existing railroad right-of-way. It crosses the Chelsea River on a new bridge and terminates at Airport Station on the Blue Line.

- **Context** - the route bisects a declining seaport serviced industrial sector in Everett, separates industrial and multi-family residential uses in Chelsea, and then follows the Blue Line/McClellan Highway corridor to the MBTA Airport Station. Much of the industrial area especially in Everett, has fallen into disuse and is becoming ripe for redevelopment. The case in Chelsea is similar, but the segment also skirts older residential areas which have declined along with the fall in adjacent industrial employment, to among the lowest level economic sectors of the metropolitan area. With nearby employment dwindling, the neighborhoods suffer from lack of easy access to current employment opportunities

- **Zoning** - is industrial in Everett, with business bounded by Second, Spruce, and Everett Streets; industrial, with residential to the south in Chelsea; and industrial and transportation corridor in East Boston extending along McClellan Highway into Logan Airport.

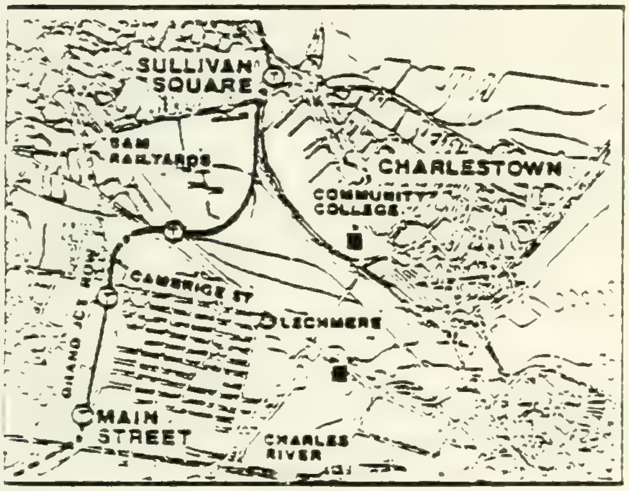
- **Development** - a sense of industrial decay predominates most of the area despite pockets of redevelopment. Residential quality is declining and the need for reinvestment is apparent.

- **Condition** - is generally poor

- **Constraints** - development on a very large scale is needed for meaningful impact on the area. This may be the major inhibitor to regeneration in the near future.

- **Potentials** - With the current efforts to restore water quality in Boston Harbor and the obsolescence of historic maritime activity, the large quantity of close-in, low-cost, waterfront property could become an attractive site for major residential and mixed-use redevelopment. While past industrial uses have not required strong transit linkages to the urban core, new residential and mixed-uses would find such connections essential. Extension of the circumferential transit loop north of the Mystic and Chelsea Rivers could play a vital role in reclaiming a major piece of urban land to productive use.

10. Grand Junction Railroad from Main Street in Cambridge to Sullivan Square



This segment is an alternative alignment to the primary corridor connecting Kendall Square, Lechmere, and Community College. It begins at Main Street on the Grand Junction Railroad and continues north through East Cambridge to Sullivan Square. Stations would be located at Broadway and Cambridge Street, in Cambridge, the Brickbottom in Somerville and Sullivan Square.

- **Context** - the route would rise from subway to the surface at Binney Street and then run entirely at-grade on the existing railroad right-of-way. Only the segment around a new station at Cambridge Street would interface with surrounding activity.

- **Zoning** - is industrial, and multi-family residential south of Cambridge Street, business at the Cambridge Street grade crossing, and industrial through the Boston & Maine Railroad yards into Sullivan Square.

- **Development** - in Cambridge is in transition with some industrial buildings along the right-of-way being remodeled to residential. North of Cambridge Street the route is within existing railyards and would have little development impact unless the yards were redeveloped for other uses.

- **Condition** - the properties between Broadway and Cambridge Streets are in fair to good condition, while north of Cambridge the railyards may be typified as decaying industrial.

- **Constraints** - the tunnel portal at Binney Street will require careful planning. The interface with the Red Line is awkward since a direct pedestrian connection to Kendall Square is not possible. The most likely solution is a shuttle bus link.

- **Potentials** - the new station near Broadway could induce more intensive development but is not as well integrated with surrounding activities as would be a station in Kendall Square. A grade-level station at Cambridge Street could also increase retail and service activity. Brickbottom Station would provide connections to the Fitchburg commuter rail line and the new Green Line extension, but the potential exists for expanded development.

IX. EVALUATION OF LONG RANGE ALTERNATIVES

This chapter summarizes the evaluation of the long range alternatives described in Chapter VII, including findings of the cost effectiveness analysis for six of the most promising alternatives compared to the TSM alternative. A year 2010 design horizon was used for all analyses. Recommendations regarding actions that should be taken regarding further study and implementation of the most promising alternatives are presented in the final chapter of the report.

Criteria were developed early in the study process for use in evaluating the long range alternatives for circumferential transit service improvements. While a comprehensive set of measures was chosen, emphasis was placed on maintaining a level of detail appropriate for systems level planning. The objective was to identify those alternatives that appear most feasible and worthy of further, more in depth study. No attempt was made in either the definition or evaluation of options to develop optimal solutions. Rather, the approach was to test a wide range of improvements to reach decisions on whether an UMTA Alternatives Analysis / Draft Environmental Impact Statement (AA/DEIS) process should be pursued; and if so, to provide information to assist in refining the corridor options for the AA/DEIS analysis.

A. EVALUATION SUMMARY

The alternatives analyzed are described in detail in Chapter VII, and summarized below:

- **Alternative 1: Baseline** - a no action alternative which includes other planned MBTA radial system improvements but no improvements within the study corridor.

- **Alternative 2: TSM** - adds low cost Transportation Systems Management improvements in the corridor to the Baseline Alternative. Included are traffic improvements and added local and express bus services

- **Alternative 3C: Core LRT** - adds a light rail line from Ruggles Station to Community College Station to the TSM improvements.

- **Alternative 3D: JFK/U Mass Core LRT** - adds an light rail extension from Ruggles Station to JFK/U Mass Station to the Core LRT Alternative 3C.

- **Alternative 3E: JFK/U Mass to Airport via Community College** - adds a light rail extension from Community College to Sullivan Square, across the Mystic River through Everett and Chelsea, and south over the Chelsea River to East Boston and Logan Airport to the JFK/U Mass Core LRT, Alternative 3D

- **Alternative 3F: JFK/U Mass to Airport via Grand Junction Railroad** - is a variant on Alternative 3E, which uses the Grand Junction Railroad alignment from Main Street in Cambridge to Sullivan Square, instead of looping through Kendall Square, Lechmere and Community College.

- **Alternative 5D: Mini Metro** - uses automated fully grade separated vehicles on an alignment virtually the same as the Core LRT Alternative 3C from Ruggles to Community College

- **Alternative 6: Guided Bus** - uses guided bus technology operating on the same alignment as the JFK/U Mass to Airport via Community College LRT, Alternative 3E.

Table IX-1 provides a summary evaluation of the results of the analysis for these eight options. The sections which follow discuss in detail the findings organized by evaluation criteria. Land use and alignment segment specific environmental and social impacts are discussed in Chapter VIII

TABLE IX-1

Year 2010
Long Range Alternatives Summary Evaluation

Criteria	2 TSM	3C Core LRT	3D Core LRT (JFK/U Mass)	3E LRT JFK/U to Airport
Daily Corridor Ridership	9 000	102,000	120 000	148 000
Daily System Wide Ridership Compared to 1987	+ 215,000	+ 275,000	+ 277 000	+ 287 000
Travel Time Savings Compared to Baseline Alternative	157 000 min./day	749 000 min./day	842,000 min./day	1 137 000 min./day
Service to Users With Special Needs	Minor Improvement	Major improvement if Green Line is made accessible.	Major improvement if Green Line is made accessible.	Major improvement if Green Line is made accessible.
Reliability	Fair to poor	Good	Good	Good
Implementation	Simple improvements, easily undertaken	Major project, no new technology.	Major project, no new technology, can be phased.	Major project, no new technology,* can be phased.
Change in Regional Vehicle Travel Compared to Baseline Alternative	- 24,000 miles/day	- 379,000 miles/day	- 385,200 miles/day	- 465,000 miles/day
Noise Impacts	Increased diesel bus operations.	Little or no change with mostly subway operation	Minor increase on surface segments.	Minor increase on surface segments.
Land Use Impacts	None	Major influence in core segment.	Major influence in core segment, stimulus for development on outer links.	Major influence in core segment, stimulus for development on outer links.
Social Impacts	Minor positive benefit.	Major service improvement to low income neighborhoods and employment opportunities.	Major service improvement to low income neighborhoods and employment opportunities.	Major service improvement to low income neighborhoods and employment opportunities
Corridor Capital Costs (1988 $)	$19,000,000	$1 033 000,000	$1 245 000,000	$1 370 000 000
Annual Operating Costs Compared to Baseline Alternative (1988 $)	+$17 000 000	- $4 000 000	- $10,000 000	- $1 000 000
Cost Effectiveness Standard Federal	Base for	$3.78	$4.18	$4.26

TABLE IX-1

Year 2010
Long Range Alternatives Summary Evaluation
(continued)

Criteria	3F LRT (JFK/U Mass to Airport via Grand Junction RR)	5D Mini Metro	6 Guided Bus
Daily Corridor Ridership	119,000	103,000	114,000
Daily System Wide Ridership Compared to 1987	+ 278,000	+ 276,000	+ 234,000
Travel Time Savings Compared to Baseline Alternative	896,390 min/day	753,000 min/day	1,115,000 min/day
Service to Users With Special Needs	Major improvement if Green Line is made accessible	Major improvement	Major improvement
Reliability	Good	Excellent	Good
Implementation	Major project, no new technology can be phased	Major project, introduces new technology	Major project introduces new technology, can be phased
Change in Regional Vehicle Travel Compared to Baseline Alternative	- 434,120 miles/day	- 382,000 miles/day	- 157,000 miles/day
Noise impacts	Minor increase on surface segments.	No impact, all subway.	Modest impact with increase in diesel bus operations
Land Use Impacts	Major influence in core segment stimulus for development on outer links.	Major influence in core	Major influence core segment stimulus for development on outer links
Social Impacts	Major service improvement to low income neighborhoods and employment opportunities.	Major service improvement to low income neighborhoods and employment opportunities.	Major service improvement to low income neighborhoods and employment opportunities
Corridor **Capital** Costs **(1988 $)**	$1,180,000,000	$1,145,000,000	$1,384,000,000
Annual Operating Costs Compared to Baseline Alternative (1988 $)	- $10,000,000	- $5,000,000	+ $13,000,000
Cost Effectiveness (Standard Federal Index)	$3.65	$4.39	$19.22

B. TRANSPORTATION

This section summarizes the findings of the evaluation of year 2010 ridership for the corridor alternatives and impacts on the core elements of the MBTA transit system. Also included are assessments of travel time impacts for users, ease of implementation, service to special needs riders, reliability and impacts on other elements of the regional transportation system.

1. Circumferential Corridor Ridership

The performance of all eight alternatives was evaluated by CTPS through application of the regional travel forecasting models. Year 2010 ridership was estimated based on forecast year 2010 population, employment and travel patterns.

Table IX-2 and Figure IX-1 summarize daily and morning peak hour ridership for the circumferential alternatives. Daily ridership varies from a low of 9,000 for the TSM alternative to a high of 148,000 for the most aggressive of the light rail options. The core corridor options between Ruggles and Community College attract slightly over 100,000 riders per day. The extension to JFK/U Mass adds approximately 18,000 riders, and the extension north through Everett, Chelsea and Logan Airport adds about 28,000 riders. The alternative alignment on the Grand Junction Railroad, missing Kendall, Lechmere, and Community College shows a ridership loss of 29,000 per day compared to the options passing through these activity centers.

TABLE IX-2
Year 2010 Daily and Morning Peak Hour Circumferential Transit Line Ridership

	Alternatives	Daily Ridership	Morning Peak Hour Ridership
1	Baseline	0	0
2	TSM	9,000	1,800
3C	Core LRT (Ruggles to Community College)	102,000	20,400
3D	LRT (JFK/U Mass to Community College)	120,000	24,000
3E	LRT (JFK/U MAss to Airport via Community College)	148,000	29,600
3F	LRT (JFK/UMass to Airport via Grand Junction Railroad)	119,000	23,800
5D	Mini Metro (Ruggles to Community College)	103,000	20,600
6	Guided Bus (JFK/UMass to Airport)	114,000	22,800

FIGURE IX-1

Year 2010
Ridership Forecast
Circumferential Corridor

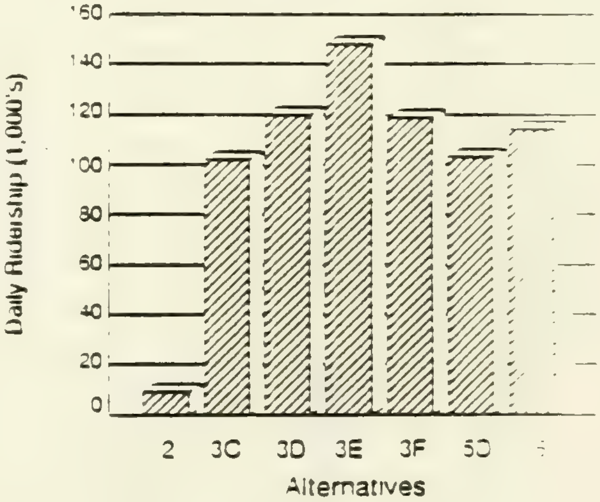


Table IX-3 summarizes daily boardings by station for the four LRT and Mini Metro Alternatives. As can be seen five stations consistently show boardings greater than 10,000 riders per day. Ruggles is the highest with 15-18,000 depending on the alternative, followed closely by Kendall Square with 14-17,000, Boston University with 13-16,000, Longwood/Brookline Avenue with 11-12,000 and MIT with 10-11,000. Stations showing boardings of less than 2,500 per day include Newmarket, Cambridge Street, and Revere Beach Parkway.

TABLE IX-3

Year 2010 Daily Circumferential Station Boardings

	Alternatives				
	3C	3D	3E	3F	5D
JFK/U Mass	---	7,120	9,250	10,150	---
Edward Everett Square	---	2,820	3,270	3,200	---
Newmarket	---	1,500	1,660	1,580	---
Melnea Cass/Mass. Ave	---	3,220	4,390	4,130	---
Melnea Cass/Wash. St.	---	2,910	3,700	3,430	---
Ruggles	14,680	18,070	16,760	15,660	14,570
Longwood/Huntington	8,410	9,190	8,890	8,380	8,420
Longwood/Brookline Ave.	11,140	12,180	11,790	11,110	11,160
Park Drive/Beacon Street	8,750	9,220	10,300	7,800	8,770
Boston University	13,990	14,460	15,560	12,660	13,980
MIT/Mass. Ave.	10,780	10,940	11,410	---	10,810
Kendall Square	16,960	14,130	16,890	---	17,380
East Cambridge	2,680	2,360	2,950	---	2,690
Lechmere	3,860	3,130	4,050	---	3,760
Community College	10,940	9,120	6,850	---	11,690
Main St./Vassar St.	---	---	---	7,730	---
Cambridge Street	---	---	---	2,150	---
Brickbottom	---	---	---	5,350	---
Sullivan Square	---	---	8,030	15,640	---
Rev. Beach Parkway	---	---	3,820	2,890	---
Mystic Mall	---	---	1,530	1,490	---
Chelsea/Broadway	---	---	4,450	2,990	---
Logan Airport	---	---	2,670	2,700	---
TOTAL	102,190	120,340	148,230	119,050	103,210

2. MBTA System Ridership

Ridership impacts on the balance of the MBTA system are summarized in Table IX-4. Figure IX-2 illustrates the impact on MBTA system-wide ridership, which varies from a low of an additional 5,000 additional daily riders under the TSM alternative to 77,000 additional riders under the most extensive of the light rail options. The core alternatives, with service from Ruggles to Community College show system-wide gains in the range of 65,000 riders per day. The contrast of system-wide ridership changes to Circumferential Line ridership illustrates that over 50 percent of the new line's ridership is diverted from other elements of the MBTA system.

FIGURE IX-2
Ridership Forecast
Total System

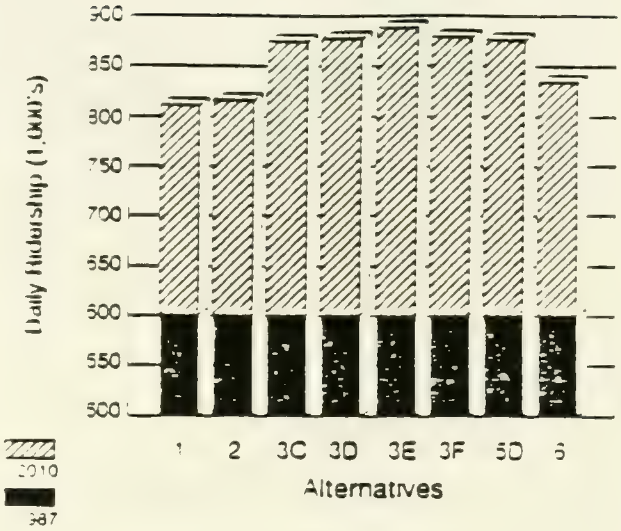


TABLE IX-4
Daily Year 2010 Ridership
(Unlinked Trips)**

Alternatives		MBTA System (Linked Trips)*	Circum-ferential Corridor	Green Line	Red Line	Blue Line	Orange Line	Commuter Rail	Bus System
1987 System		601,000	0	195,000	178,000	44,000	144,000	65,000	362,000
1	Baseline	811,000	0	270,000	257,000	57,000	186,000	91,000	430,000
2	TSM	816,000	9,000	261,000	254,000	57,000	187,000	92,000	440,000
3C	Core LRT (Ruggles to Community College)	876,000	102,000	254,000	265,000	59,000	199,000	109,000	427,000
3D	LRT (JFK/U Mass to Community College)	878,000	120,000	252,000	261,000	59,000	201,000	110,000	412,000
3E	LRT (JFK/U Mass to Airport via Community College	888,000	148,000	250,000	261,000	52,000	196,000	112,000	392,000
3F	LRT (JFK/U Mass to Airport via Grand Junction Railroad	879,000	119,000	256,000	261,000	54,000	201,000	109,000	408,000
5D	Mini Metro (Ruggles to Community College)	877,000	103,000	254,000	265,000	59,000	199,000	109,000	427,000
6	Guided Bus (JFK/UMass to Airport)	835,000	114,000	231,000	250,000	48,000	191,000	102,000	492,000

* Linked Trips are the total weekday trips made on the MBTA system; thus, a trip involving transfer from the Orange Line to the Red Line counts as only one linked trip

** Unlinked Trips are the total average weekday passenger trips on each line or mode; thus, a trip involving a transfer from the Orange Line to the Red Line counts as one trip on each line

Figure IX-3 shows that daily Green Line ridership declines with the implementation of the Circumferential Line. Green Line ridership decreases range between 15.000 and 20.000 per day for most of the alternatives except for the Guided Bus. The latter decreases Green Line use by nearly 40.000 riders. since it includes a number of express routes operating to the west and paralleling the Green Line. As discussed in the following section. reduction of Green Line ridership is beneficial to relieving existing and forecast future overcrowding on this line.

From Table IX-4 it can be seen that Orange Line ridership increases slightly under all of the major build alternatives. Increases are nearly the same for the LRT and Mini Metro Alternatives. Increases are slightly less for the LRT option without a Community College Station and the Guided Bus Alternative. These results occur because of the overall improvement in regional transit access afforded by implementation of the Circumferential Line

FIGURE IX-3

Ridership Forecast
Green Line

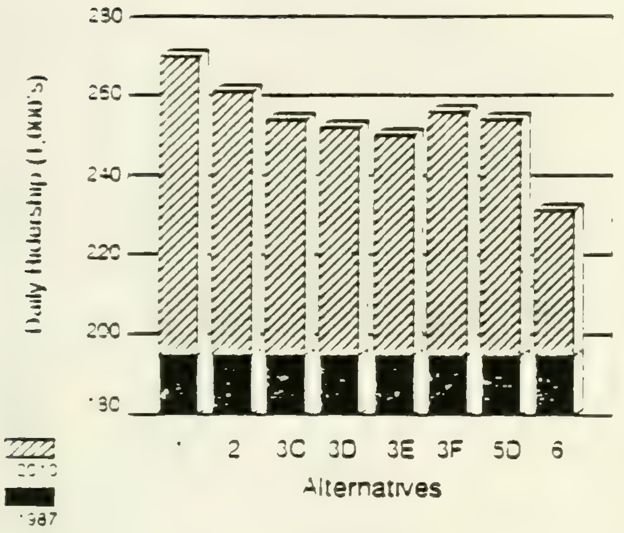


FIGURE IX-4

Ridership Forecast
Red Line

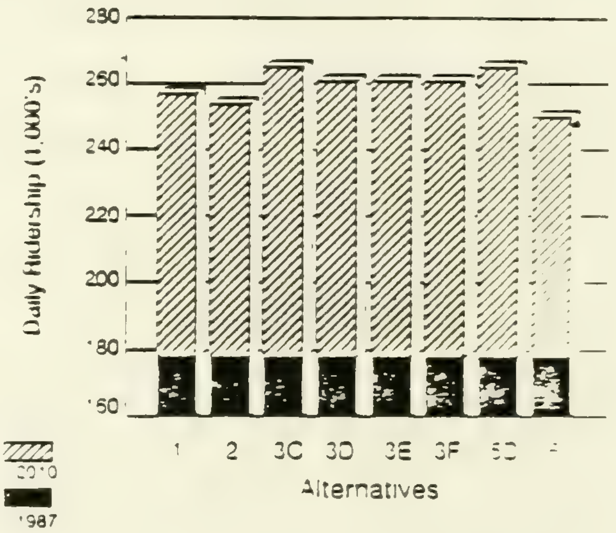


Figure IX-4 shows that Red Line ridership increases slightly under all of the major build alternatives. except the Guided Bus. The most likely explanation is that the Circumferential Line enhances Red Line access to areas such as Boston University and Longwood. particularly from the Alewife and Harvard Square areas. Some riders also use the Circumferential Line to reach JFK/U Mass and then the Red Line to points in South Boston and the South Boston Piers area. The lower Red Line ridership with the Guided Bus Alternative is a result of the diversion of Red Line riders to the Guided Bus route on Blue Hill Avenue.

From Table IX-4 it can be seen that Blue Line ridership is impacted little by the Circumferential Line. The Blue Line shows minor increases with the alternatives not having a Logan Airport link and modest decreases for those options with the Airport link. The former occurs because of overall improvements in regional transit access as a result of the Circumferential Line. The latter occurs as riders are diverted from the Blue Line to the Circumferential Line at stations in East Boston and Chelsea.

Figure IX-5 shows that ridership on the commuter rail system increases by over 20 percent under the Light Rail and Mini Metro Alternatives. This occurs primarily as a result of the connection at Community College Station, which greatly improves north side commuter rail access to the rapid growth areas in Cambridge, the Boston University area, and to a lesser extent the Longwood area. Surprisingly, the connection to the Old Colony Line at JFK/U Mass has only a modest impact of 2,000 additional riders per day.

FIGURE IX-5

Ridership Forecast
Commuter Rail

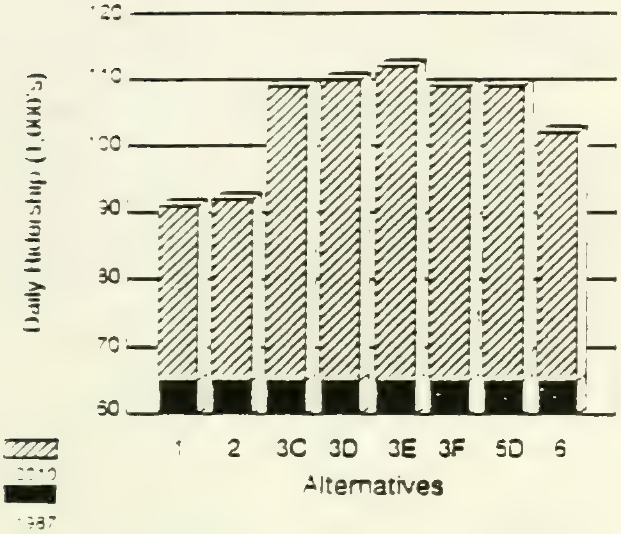


FIGURE IX-6

Ridership Forecast
MBTA Bus System

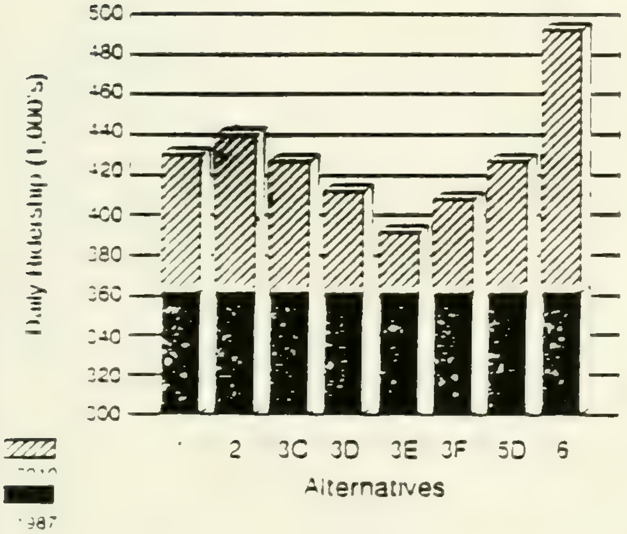


Figure IX-6 illustrates impacts on total bus system ridership. As would be expected bus ridership drops are large ranging from 13,000 to 48,000 riders per day depending on the alternative. A fixed transit facility in the core segment from Ruggles to Community College diverts approximately 13,000 riders per day. An additional 15,000 riders per day are diverted by the extension to JFK/U Mass. and another 20,000 riders switch from bus to the Circumferential Line as a result of the extension through Everett, Chelsea and East Boston to Logan Airport.

3. Impacts on Core Area Radial Lines

One of the major objectives of developing the Circumferential Line is to relieve existing and anticipated future over-crowding on the central portions of the MBTA transit system. Of greatest concern are the following segments:

- Green Line between Government Center and Copley,
- Red Line between Charles and Broadway,
- Orange Line between North Station and Backbay, and
- Blue Line between Airport and State.

To assess these impacts, a study was undertaken of the implications on these segments of the forecast year 2010 transit loadings. The analysis was conducted for the Circumferential TSM Alternative 2 and two Circumferential Light Rail Alternatives 3C and 3E. In addition, the latest available network from the South Boston Piers Study was analyzed. The latter network does not include the Red Line Loop and Fan Pier Station or improvements in the circumferential corridor. (A "People Mover" connection from Boylston Station on the Green Line through South Station to the South Boston Piers area is included instead.) The latest South Boston Piers model is a more recent calibration and reflects a more likely configuration for the balance of the year 2010 MBTA system than the network used in testing the Circumferential Line alternatives. The analysis procedure was to first determine peak hour and peak 15 minute passenger capacities of the key radial line segments and then compare these to the forecast peak hour and peak 15 minute line loadings supplied by CTPS. The MBTA's 1995 operating plan expanded to the year 2010 served as the basis for estimation of future radial line capacity.

The results of this analysis are summarized in Table IX-5. The maximum forecast passenger loadings and location of the peak link on each line are shown for the peak hour and peak 15 minute periods. Also shown is the estimated maximum link capacities for the comparable periods.

The following sections summarize the findings and conclusions for the four lines analyzed.

a. Blue Line

Blue Line ridership on the peak link between Maverick and Aquarium Stations is only modestly impacted by the Circumferential Line alternatives. The most significant conclusion from Table IX-5 is that forecast volumes with the latest transit network increase substantially over those produced by the circumferential model runs. The most likely explanation for this is the more recent model calibration, which shows a large increase in boardings at Maverick Station. As a result it would now appear that the peak 15 minute capacity will be exceeded by over 20 percent and that over 80 percent of the hourly capacity will be utilized by the year 2010. This would indicate that serious problems could develop on the Blue Line even with the expansion to 6 car trains operating at 3.5 minute headways. Additional model runs with the circumferential alternatives on the latest network would be required to determine whether implementation of the Circumferential Line would have a positive or negative impact on this problem.

b. Orange Line

Orange Line ridership on the peak link between Haymarket and State Street Stations is only modestly impacted by the circumferential alternatives. Under all cases, it appears that both peak hour and peak 15 minute volumes can be accommodated comfortably with the operation of 6

TABLE IX-5

Impacts on Peak Link Ridership for Rapid Transit Lines
in the Year 2010

	Maximum One-Way Capacity	Forecast Link Volumes			
			Circumferential Alternatives		
		Fan Pier Network	2 TSM	3C LRT	3E LRT
Blue Line					
Peak Link		Maverick/ Aquarium	Maverick/ Aquarium	Maverick/ Aquarium	Maverick/ Aquarium
Peak Hour	11,300	9,100	5,800	6,400	5,500
Peak 15 Min	2,800	3,400	2,100	2,400	2,000
Orange Line					
Peak Link		NE Med./ Chinatown	Haymarket/ State	Haymarket/ State	Haymarket/ State
Peak Hour	15,900	9,300	9,300	9,100	8,800
Peak 15 Min	4,000	3,100	3,100	3,000	2,900
Red Line					
Peak Link		Park/ Charles	So. Station/ Fan Pier	So. Station/ Fan Pier	So. Station/ Fan Pier
Peak Hour	21,600	12,700	11,400	11,400	10,700
Peak 15 Min.	5,400	7,000	6,200	6,500	5,800
Green Line					
Peak Link		Boyalston/ Park	Boylston/ Park	Boylston/ Park	Boyalston/ Park
Peak Hour	16,700	15,000	9,000	7,000	6,500
Peak 15 Min	4,200	5,300	3,200	2,500	2,300

car trains at 3.5 minute headways in the year 2010. The only change apparent in the South Boston Piers model run is the shifting of the peak link location form the segment between Haymarket and State to the segment between the Chinatown and New England Medical Center Stations. Peak link volumes remain virtually the same.

c. Red Line

Red Line ridership on the peak link between South Station and Fan Pier Stations increases or decreases slightly depending on the circumferential alternative examined. The Circumferential Core Alternatives 3C and 5D increase volumes, while the extension to JFK/U Mass under Alternatives 3D, 3E, 3F, and 6 decrease volumes on the peak link. The most recent South Boston Piers model run shifts the peak load point on the Red Line to the segment between Park and Charles Stations and shows a jump of about 1,000 riders per hour compared to the Circumferential TSM Alternative 2. Assuming the operation of 6 car trains at 3 minute headways, peak hour volumes can be comfortably handled under all cases analyzed; however, the peak 15 minute volumes will exceed capacity by as much as 30 percent if current peaking conditions continue. Because of the significant differences in the Red Line networks used in the model runs, the degree to which circumferential alternatives might reduce or increase overcrowding cannot be determined without additional model runs.

d. Green Line

Green Line ridership on the peak link between Park and Boylston Stations decreases significantly depending on the alternative. The Circumferential Core Alternatives 3C and 5D decrease volumes by over 20 percent, while Alternatives 3D, 3E, 3F and 6 which extend beyond the core alignment decrease volumes by nearly 30 percent. The most recent South Boston Piers model runs show a substantial increase in Green Line peak link volumes. This result is most likely caused by the more recent calibration and the South Boston Piers link intersecting the Green Line at Boylston Station, adding ridership to the Park to Boylston link. Under the South Boston Piers Study network, theoretical peak hour capacity is nearly fully utilized and peak 15 minute capacities are exceeded by over 25 percent in the year 2010. Because of the significant differences in the networks used in the model runs, the degree to which circumferential alternatives might reduce overcrowding on the Green Line cannot be determined without additional model runs.

4. Travel Time Impacts

Another primary objective of the Circumferential Line is to improve transit access to destinations in the corridor. A significant measure of improved access is the change in travel time for users of the transit system. To determine the travel time impacts, the year 2010 TSM Alternative was used as a base. The travel time savings or travel time improvement of each alternative compared to the TSM Alternative was then calculated. This was accomplished by comparing total travel time for TSM Alternative trips loaded on the networks of each of the alternatives. As a result, the volume of trips is held constant, while travel times change depending on the performance of each of the alternatives.

The results of this analysis are summarized Table IX-6. As can be seen savings are substantial. The core corridor options, with service from Ruggles to Community College, produce daily savings on the order of 600,000 minutes per day, while the options that extend service to the north and around to Logan Airport produce savings approaching 1,000,000 minutes per day.

TABLE IX-6

Year 2010 Daily Systemwide
Travel Time Savings
Compared To TSM Alternative

Alternative	Daily Travel Time Savings (minutes)
1 Baseline	+ 156.840
2 TSM	---
3C LRT	- 592.270
3D LRT	- 685.200
3E LRT	- 980.050
3F LRT	- 739 550
5D Mini Metro	- 596 510
6 Guided Bus	- 958 040

5. System Requirements

A transit line in the circumferential corridor impacts the vehicle requirements for most elements of the MBTA system. Table IX-7 summarizes year 2010 system wide transit vehicle requirements for the various alternatives. Depending on the Circumferential Line alternative, the vehicle fleets needed to operate the Red and Green Lines and the bus system will vary. Ridership impacts on the Orange and Blue lines are small enough that no significant change in vehicle requirements occurs.

TABLE IX-7

Year 2010 MBTA System Requirements
(including 15% spares)

		Alternatives							
System Component	Existing 1987	1	2	3C	3D	3E	3F	5D	6
Red Line Cars	134	306	306	320	292	292	292	320	292
Orange Line Cars	98	146	146	146	146	146	146	146	146
Blue Line Cars	66	98	98	98	98	98	98	98	98
Green Line Cars	99	199	197	183	185	182	182	185	182
Mattapan Line Cars	9	9	9	9	9	9	9	9	9 *
Buses	876	1013	1076	1023	1011	1003	1009	1022	1078
Guided Buses	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	118
Circumferential Light Rail Cars	N/A	N/A	N/A	25	31	53	37	N/A	N/A
Circumferential Mini Metro Cars	N/A	N/A	N/A	N/A	N/A	N/A	N/A	28	N/A

* Minimum number of vehicles required to operate each system component based on CTPS model simulation

6. Service to Users with Special Needs

Implementation of the Circumferential Line alternatives would result in significantly improved access to the large number of employment opportunities, educational facilities, medical facilities and cultural opportunities located in the corridor. From this respect, the core alignment options connecting Ruggles to Community College serve most of the corridor's major destinations. The extension to JFK/U Mass adds service to the University of Massachusetts campus at Columbia Point. The northward extensions improve access to the core corridor from population centers in Everett and Chelsea, and add service to Logan Airport. The latter, however, is judged to be only a modest improvement in transit access to the airport, primarily from areas in Everett and Chelsea.

System access for the mobility impaired will be a function of the technology chosen and summarized as follows for the four primary vehicle options:

- **Conventional Bus:** Buses purchased for Circumferential Line service would be lift equipped and could accommodate wheelchair users.
- **Guided Bus:** Guided buses purchased for Circumferential Line service would be lift equipped and could accommodate wheelchair users. In addition, guideway sections of the corridor could be developed with high platform stations allowing direct wheelchair access not requiring use of a lift. This would require the purchase of buses with high/low steps or the

addition of door(s) on the left side of the bus with heights matching station platforms. All guideway stations whether at-grade, in subway or on aerial structure would be fully accessible to wheelchairs via ramps or elevators as determined appropriate during the design phase.

- **Light Rail:** For purposes of this feasibility study light rail vehicles interchangeable with those operated on the Green Line were assumed. The existing Type 7 vehicle is neither lift equipped nor capable of high platform loading. However, the MBTA has initiated a study examining the cost and feasibility of implementing various accessibility options for the Authority's light rail system. Until decisions are made at the conclusion of the Green Line Accessibility Study the nature of wheelchair access to Green Line vehicles in the year 2010 is not possible to assess.

- **Mini Metro:** Mini metro technology would operate with high platform stations, allowing direct wheelchair access. All stations, whether at-grade or aerial would be fully accessible to wheel chairs via ramps or elevators as determined appropriate during the design phase.

An additional consideration related to travel by the mobility impaired are the transfers that riders must make to complete trips on the system. Under the conventional bus alternatives, these transfers require movement between rail system stations and bus stops located on street. Under the guideway alternatives, that provide full accessibility, these transfers would occur in a more controlled station environment. In general, the latter should provide a more convenient and barrier free environment.

7. Reliability

The reliability of the alternatives is both a function of the reliability of the technology and the degree to which vehicles are subject to unpredictable delays caused by traffic congestion.

From the standpoint of technology, the TSM Alternative 2, light rail (Alternatives 3C, 3D, 3E and 3F) and mini metro (Alternative 5) are all proven technologies with significant operating experience in a variety of environments. All of these options are generally equal in reliability with a possible minor advantage to the light rail and mini metro systems over conventional bus. Actual revenue operation of the guided bus technology (Alternative 6), however, is quite limited. While there is no inherent reason for this technology to be less reliable than the others, this lack of experience means that breakdowns may be more frequent and the length of time needed to debug problems will be longer.

The most important factor affecting reliability is the degree to which the alternatives separate transit operations from conflicts with other traffic. This is of particular concern in the circumferential corridor given existing and future traffic congestion. From this standpoint the fully grade separated Mini Metro Alternative 6 would be superior to the others. The Core LRT Alternative 3C having minimal cross traffic interference should perform nearly as well, followed by 3D, 3E and 3F which have some mixed traffic light rail operations. The Guided Bus Alternative 6 with more mixed traffic operations than the light rail options would be next. The Baseline Alternative 1 and TSM Alternative 2 would be the least reliable since bus operations would be in mixed traffic throughout the corridor.

8. Implementation

Two factors were considered in judging the ease of implementation. First, the compatibility of the alternative technologies with those currently operated by the MBTA was assessed. Second, phasing opportunities and strategies were identified for each alternative. An important consideration with regard to the latter was the identification of the minimum segment that would have to be implemented to provide a functional system.

The TSM Alternative 2, and all of the light rail options (Alternatives 3C, 3D, 3E and 3F) involve vehicle technologies now operated by the MBTA. Any additional rolling stock purchases and maintenance base expansion would be required, all of vehicles involved would be interchangeable with other MBTA operations.

The Guided Bus Alternative 6 would introduce a new technology to the system. However, with the exception of the guideway itself, the guided bus combines diesel and electric powered buses not that dissimilar to the MBTA's current bus fleet. Maintenance could be accommodated by expanding existing bus bases, and the guided bus probably would not introduce major new system requirements. In addition, guided buses might be used elsewhere in the MBTA system outside circumferential corridor.

The Mini Metro Alternative 5 introduces a completely new technology, a new veh

maintenance facility would be required. Guideway and control systems would be different from those on the balance of the rapid transit system and the vehicles would be limited to exclusive use on the Circumferential Line. However, an exception to the latter might occur if a decision were made to use the mini metro technology for the South Boston Piers system, now under study.

Implementation considerations with regard to phasing opportunities for each alternative include the following:

- **Alternative 2: TSM** - implementation of this alternative can be phased in relatively small, incremental steps. By its nature the TSM Alternative's bus routes and traffic improvements are low cost and flexible. The major high cost item would be the new Turnpike connection to the Grand Junction Railroad Bridge. However, the express bus routes using this connection could be implemented prior to completion of the modifications to the Allston/Brighton interchange.

- **Alternative 3C: Core LRT** - implementation of this alternative would require the construction of a minimum useable segment of light rail line. From a service standpoint, the minimum functional segment would have to extend from Ruggles Station on the Orange Line to Kendall Square on the Red Line. Nearly all of this approximately four mile link would require high cost subway construction. In addition, the segment from Kendall Square to Lechmere would be needed to provide maintenance facility access, unless a connection to one of the four Green Line Branches were made in the Longwood area. The final segment to Community College from Lechmere is short and of high utility and probably should be included. Thus, the entire alignment from Ruggles to Community College might require development as a single project.

- **Alternative 3D: JFK/U Mass Core LRT** - adds an light rail extension from Ruggles Station to JFK/U Mass Station to the Core LRT, Alternative 3C. This extension could occur in segments. The highest cost pieces are the subway segment near Boston City Hospital and the interface at JFK/ U Mass Station.

- **Alternative 3E: JFK/U Mass to Airport via Community College** - adds a light rail extension from Community College to Sullivan Square, across the Mystic River through Everett and Chelsea, and south over the Chelsea River to East Boston and Logan Airport to the JFK/U Mass Core LRT Alternative 3D. Most of this extension is at-grade and could be implemented in segments.

- **Alternative 3F: JFK/U Mass to Airport via Grand Junction Railroad** - is a variant on Alternative 3E, which uses the Grand Junction Railroad alignment from Main Street in Cambridge to Sullivan Square, instead of looping through Kendall Square, Lechmere and Community College. The variation on the core alignment through Cambridge would require a commitment to this option at the time the core system from Ruggles to Main Street was implemented. If such a decision were made the minimum core option would need to be extended to Brickbottom and Sullivan Square to gain access to a maintenance facility and provide connections to the Orange Line and north side commuter rail services.

- **Alternative 5D: Mini Metro Core Alignment** - as with the similar light rail option, the minimum useable segment appears to be full development of this system from Ruggles to a maintenance facility north of Community College Station.

- **Alternative 6:** Guided Bus - because of the flexibility of the dual propulsion technology this alternative offers the most options for incremental development. The primary consideration relates to developing useful tunnel segments short of a full subway from Ruggles to Kendall Square. Consideration must be given to the cost and disruption of temporary transition and portal sections if the entire tunnel were not built. The most logical first segment might be the subway link from Huntington Avenue at Ruggles Street to a portal on the north bank of the Charles River in Cambridge.

9. Impact on Other Modes

The alternatives will have varying impacts on other transportation modes in the corridor. Considered here are general traffic, rail freight, commuter rail, and pedestrian impacts, together with considerations related to construction impacts.

Traffic impacts will be most positive for the major construction options (Alternatives 3C through 6) which could divert as many as 75,000 daily auto person trips in the corridor to transit, while at the

same time reducing bus volumes on the most congested arterials. The least positive impacts will be seen from the TSM alternative where diversion of only 5,000 auto person trips is forecast, and bus volumes on congested arterials will increase.

Those alternatives utilizing rail rights-of-way will require coordination with freight and in some cases commuter rail operations. This is most significant for Alternatives 3E, 3F and 6, which utilize Conrail right-of-way from Sullivan Square through Everett and Chelsea. The most sensitive issues will likely involve pedestrian access to at-grade stations, which will require careful consideration during further planning and design. Alternatives 3C, 3D and 5 utilize very little rail right-of-way at-grade, and will have few if any impacts on existing rail freight operations.

All of the major build alternatives propose the addition of commuter rail stations at the intersections with the Circumferential Line. These stations would be developed on the Framingham Line near Boston University, on the North Station Lines at Community College (under Alternative 3F this station would be replaced by stations at Brickbottom and Sullivan Square), and on the Old Colony Lines at JFK/U Mass. While these stops will add some running time to all of the lines, they will also increase ridership. Increases in commuter rail ridership are most dramatic as a result of the connections provided to the North Station Lines.

Pedestrian impacts of the major construction alternatives generally will be positive. In areas such as Kendall Square the new stations can act as organizing elements in a larger pedestrian network. In areas such as Lechmere and MIT/University Park they could become a focus for development. In built-up areas such as Longwood and Boston University new stations could improve overall pedestrian access and circulation.

Construction impacts are another important consideration. All of the major investment options (Alternatives 3C through 6) involve significant construction, most of which would occur below existing street and rail rights-of-way. Depending on whether cut-and-cover or boring methods are used impacts on traffic and rail operations will vary. Regardless, construction will be most significant around stations. In areas such as Longwood and Kendall Square great care will be required to keep disruptive activities to a minimum. At this level of analysis specific impacts are difficult to identify, but will require careful consideration if further study of the alternatives is undertaken.

C. ENVIRONMENT

Many environmental considerations associated with development of the various corridor segments are discussed in detail in Chapter VIII. This section provides a brief overview of general impacts related to noise, air quality and energy consumption.

1. Noise Impacts

Noise impacts of transit operations along the corridor will vary depending on alternative technology and whether the segment is at-grade, on aerial structure or in tunnel. As discussed in Chapter VIII, the primary corridor for the major build alternatives (Alternatives 3C through 6) passes through many areas of high environmental sensitivity and if developed will most likely be located predominantly in subway. In the subway segments noise impacts on surrounding sensitive uses will be minimal. In those portions of the core corridor and corridor extensions located at-grade or on aerial structure (beyond Kendall Square to the east and north and beyond Huntington Avenue to the south and east), noise impacts to surrounding receptors will vary depending on the vehicle technology.

Figure IX-1 illustrates typical pass-by noise levels for existing MBTA technologies, including three of the four possible Circumferential Line alternatives. Noise levels for the mini metro option, which are not shown, would generally fall between those shown for MBTA trackless trolley and MBTA LRV Green Line, depending on whether the vehicles are steel wheeled or rubber tired. Guided buses will have noise signatures similar to either diesel buses or trackless trolleys depending on operating mode.

2. Air Quality

While a detailed air quality analysis was not undertaken as part of the feasibility study the impacts of the alternatives can be gauged based on the transit technology chosen for service in the corridor and the degree to which regional automobile miles of travel are reduced in the region.

The light rail alternatives (3C, 3D, 3E, 3F) and the mini metro alternative (5D) are electrically powered and will produce no mobile source pollutants. Depending on the source of electricity some increase in point source emissions could result from the burning of hydrocarbon fuels. Those alternatives using diesel buses (1, 2, and 5) will result in an increase in mobile source emission

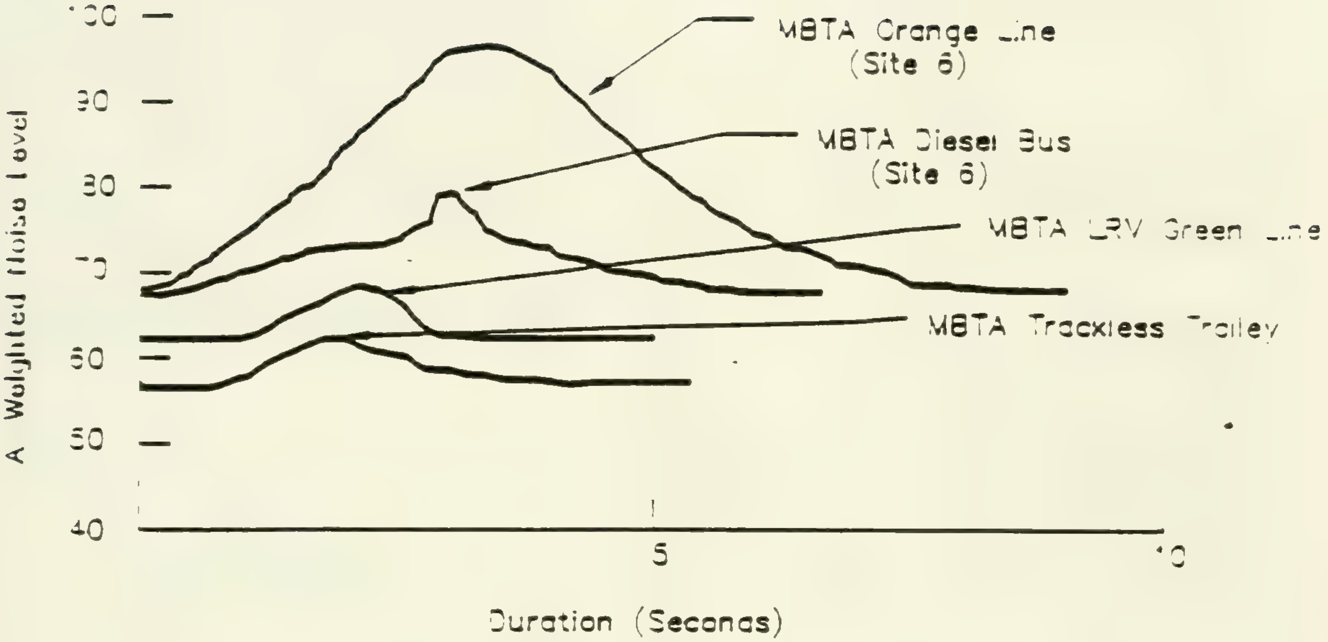


FIGURE IX-1
Noise Comparisons of MBTA Modes

from the diesel engines. Minor increases in hydrocarbons, oxides of nitrogen, and particulates will occur, along with diesel bus odor.

The change in regional vehicle miles of travel (VMT) provides an indirect measure of the impact on corridor and regional air quality that could result from implementation of one of the alternatives. Table IX-8 summarizes the change in daily VMT compared to the TSM Alternative 2. From this table it can be seen that service in the primary corridor between Ruggles and Community College (Alternatives 3C and 5D) produces reductions in excess of 350,000 vehicle miles per day. The extension to JFK/U Mass (Alternative 3D) results in an additional savings of approximately 5,000 vehicle miles per day. Service to the north and extension down to Logan Airport (Alternatives 3E and 3F) produces further savings 50,000 to 80,000 vehicle miles of travel, depending on the alignment. The Guided Bus Alternative 6 produces the lowest smallest savings of the major built alternatives at slightly more than 132,000 vehicle miles per day.

TABLE IX-8

Year 2010 Change in Regional Vehicle Miles of Travel (VMT)

Alternative	Change in Daily VMT Compared to TSM Alternative
1 Baseline	+ 24,440
2 TSM	—
3C Core LRT (Ruggles to Community College)	- 354,970
3D LRT (JFK/U Mass to Community College)	- 360,760
3E LRT (JFK/U Mass to Airport via Community College)	- 440,680
3F LRT (JFK/U Mass to Airport via Grand Junction Railroad)	- 409,680
5D Mini Metro (Ruggles to Community College)	- 357,900
6 Guided Bus (JFK/U Mass to Airport)	- 132,750

3. Energy

While a detailed energy consumption analysis was not undertaken as part of the feasibility study, the impacts of the alternatives can be judged based on the transit technology operated in the corridor and the degree to which regional auto travel is reduced. The findings of this assessment are essentially the same as those discussed in the previous section dealing with air quality.

D. COST EFFECTIVENESS

This section summarizes the results of the cost effectiveness analysis of the long range alternatives. Included are estimates of operating and capital costs along with a summary of the analysis methodology and the study findings.

Because the circumferential alternatives significantly impact many of the MBTA's rapid transit lines and bus services, a system wide approach to the analysis was used. This approach entailed developing ridership, operating cost and capital cost information for all rapid transit lines and bus routes in the year 2010 for each of the alternatives analyzed. The cost effectiveness analysis was then conducted on a system-wide basis, using the TSM alternative as a baseline.

This approach allowed the analysis to "capture" cost savings and/or increases that would accrue to the other components of the transit system as a result of a major capital improvement in the circumferential corridor. This is important, since one of the major benefits of the circumferential improvements is to divert riders from the central core, peak load points, of the Red, Green, and Orange Lines. This diversion produces operating cost savings, since service levels can be reduced on these congested links, and capital cost savings since fewer trains are required during peak periods. In conducting the analysis, only capital costs associated with vehicle requirements were included for non-circumferential lines. No attempt was made to estimate other cost savings that might occur. Other possible savings include a reduction in improvements to fixed facilities such as stations, track, switches and maintenance facilities that might be needed to accommodate the higher ridership and larger vehicle fleet needed on these lines if the circumferential improvements are not built.

1. Analysis Methodology

Cost effectiveness, in relation to transit projects, is defined as the extent to which an alternative returns benefits in relation to its costs. The evaluation of cost effectiveness through Alternatives Analyses conducted under U.S. Urban Mass Transportation Administration (UMTA) procedures provides a means for Federal, State and local officials to rate various alternatives in terms of their benefits to the affected community and to compare various projects to determine priorities for receipt of available funds.

The first index calculated in the analysis is referred to as the Standard Federal Index in that it represents the cost of a project in Federal funds compared to its total benefits. Included in the cost component is credit for state and/or local contributions of project funds.

The index representing the Federal perspective is computed as:

$$\text{Standard Federal Index} = \frac{\Delta \$CAP + \Delta \$O\&M - \Delta \$TT - \Delta \$LOC}{\Delta \text{ RIDERS}}$$

where the Δ's represent changes in costs and benefits compared to the TSM alternative, and

$CAP = total capital costs, annualized over the life of the project;
$O&M = annualized operating and maintenance costs;
$TT = annualized value of travel time savings for existing riders;
$LOC = annualized value of local, State, and private capital funding;
RIDERS = annual transit ridership, measured in "linked" trips.

The second index represents the perspective of society, in general, by comparing total funds required to the benefits of the project. This index is referred to as the Standard Total Index. This index, representing the total cost to society, is computed as:

$$\text{Standard Total Index} = \frac{\Delta \$CAP + \Delta \$O\&M - \Delta \$TT}{\Delta \text{ RIDERS}}$$

As noted, each alternative is compared in terms of costs and benefits to the Transportation System Management (TSM) alternative, the alternative considered the best service that can be implemented without a major financial investment. In either case, these indices represent the cost of attracting each new rider to the system for the alternative being evaluated. In applying these indices, UMTA has established threshold tests that require an index of $10.00 per new rider in 1984 dollars for an alternative to enter into alternatives analysis.

Recognizing certain limitations in the original indices, UMTA has proposed revised indices to more fully account for benefits that a proposed alternative provides for both existing riders and new users. The revised indices use the concept of "user benefit" as the measure of value in the formula's denominator, expressed in hours of travel time

The revised index representing the perspective of the Federal government, in which the Federal funds needed for the project are compared to its total benefits, is:

$$\text{Revised Federal Index} = \frac{\Delta \$CAP + \Delta \$O\&M - \Delta \$LOC}{\Delta \text{ USER BENEFITS}}$$

where the Δ's represent changes in costs and benefits compared to the TSM alternative, and
$CAP = total capital costs, annualized over the life of the project;
$O&M = annualized operating and maintenance costs;
$LOC = annualized value of local, State and private capital funding;
USER BENEFITS = benefits to both "existing" transit riders and new transit riders measured in hours of travel time

The index used to represent society's perspective is similar, omitting only the term for local match and is computed as:

$$\text{Revised Total Index} = \frac{\Delta \$CAP + \Delta \$O\&M}{\Delta \text{ USER BENEFITS}}$$

Both indices represent the cost of producing each additional hour of user benefit gained by a given alternative. In applying these indices UMTA has proposed threshold tests that require an index of $12.00 per hour of user benefits in 1984 dollars in order for an alternative to enter into alternatives analysis.

Both forms of cost-effectiveness indices were calculated for a total of six long range

Circumferential Transit alternatives. The alternatives for which indices were calculated are:

- Alternative 3C - Core Light Rail Transit (LRT)
- Alternative 3D - JFK/U Mass Core LRT
- Alternative 3E - JFK/U Mass to Airport LRT via Community College
- Alternative 3F - JFK/U Mass to Airport LRT via Grand Junction
- Alternative 5D - Mini Metro Core Transit
- Alternative 6 - Guided Bus Transit

All costs and monetary benefits were calculated in 1988 dollars. Discounting costs and benefits to 1984 dollars, for comparison with UMTA threshold indices, would reduce the values of the indices calculated by this analysis.

2. Capital Costs

Capital costs for the circumferential corridor improvements were developed based on right-of-way and corridor construction costs and vehicle purchase costs. Table IX-9 presents the estimated capital costs of all the alternatives in 1988 dollars. All costs were estimated based on the conceptual engineering analysis and include an 18 percent factor for design and engineering and a 20 percent factor for right-of-way acquisition and contingencies. Table IX-9 also contains the capital cost estimates for other elements of the MBTA system under each of the alternatives analyzed compared to the TSM Alternative. Included in this category are estimates of vehicle purchase costs only. The final column in Table IX-9 indicates the estimated net incremental system capital cost of each alternative compared to the TSM Alternative.

TABLE IX-9

Capital Cost Estimates
Long Range Alternatives
(in millions 1988 $)

	Alternative	Circumferential Line Costs				
		Right-of-Way Development	Vehicles	Total	Other Vehicle Costs**	Total Net System Costs**
1	Baseline	$0	$0	$0	($19)	($38)
2	TSM*	$10*	$9	$19	$0**	$0**
3C	CORE LRT (Ruggles to Community College)	$997	$36	$1,033	($18)	$996
3D	LRT (JFK/U Mass to Community College)	$1,203	$42	$1,245	($61)	$1,165
3E	LRT (JFK/U Mass to Airport via Community College)	$1,294	$76	$1,370	($67)	$1,275
3F	LRT (JFK/U Mass to Airport via Grand Junction Railroad)	$1,128	$52	$1,180	($66)	$1,095
5D	MINI METRO (Ruggles to Community College)	$1,118	$27	$1,145	($15)	$1,111
6	GUIDED BUS (JFK/U Mass to Airport)	$1,274	$110	$1,384	($52)	$1,313

* TSM costs for modifications to Mass Turnpike and Grand Junction Railroad are not included

3. Operating and Maintenance Costs and Operating Revenue

Table IX-10 shows the estimated operating and maintenance costs for the entire MBTA system not including the commuter rail lines, for the year 2010 with the various Circumferential Line alternatives. All costs are expressed in 1988 dollars. Operating costs were estimated for each rail line of the MBTA system using a single factor model of operating cost per vehicle-mile for 1988. Conventional and guided bus gross operating costs were calculated separately, based on the number of vehicles required multiplied by an annual operating cost per bus provided by the MBTA

Table IX-10 also shows estimates of year 2010 operating revenue, expressed in 1988 dollars. Revenue was calculated directly by CTPS, using the outputs of the UTPS model with factors developed by CTPS for other MBTA analyses, and using the current MBTA fare structure. Revenue was subtracted from gross operating costs to determine net operating costs.

TABLE IX-10

Year 2010 MBTA System Wide
Annual Operating and Maintenance
Costs and Revenues
(in millions 1988 $)

		Operating Costs	Operating Revenues	Net Operating Costs
1	Baseline	$483	$170	$313
2	TSM	$501	$171	$330
3C	CORE LRT (Ruggles to Community College)	$493	$184	$309
3D	LRT (JFK/U Mass to Community College)	$486	$183	$303
3E	LRT (JFK/U Mass to Airport via Community College)	$497	$185	$312
3F	LRT (JFK/U Mass to Airport via Grand Junction Railroad)	$488	$185	$303
5D	MINI METRO (Ruggles to Community College)	$492	$184	$308
6	GUIDED BUS (JFK/U Mass to Airport)	$506	$180	$326

4. Cost Effectiveness Indices

Six cost effectiveness indices were calculated for each of the six major build alternatives. The standard index was calculated as a total and with a 30 percent and 50 percent local match. The revised index was calculated as a total and with a 30 percent and 50 percent local match. The summary results of this analysis are presented in Table IX-11

For the standard index all of the Light Rail Alternatives 3C, 3D, 3E, and 3F, as well as the Mini Metro Alternative 5D, fall well within the UMTA threshold test for an alternative to enter Alternatives Analysis, regardless of the level of match. While Alternative 3F (Light Rail from JFK/U Mass to the Airport via the Grand Junction Railroad) shows the lowest cost per added rider, differences among the Light Rail and Mini

alternatives are not significant at this level of analysis. Only the Guided Bus Alternative 6 exceeds the $10.00 per new rider test and requires a local match in excess of 30 percent to come within this threshold. The poor performance of the Guided Bus Alternative is partly a result of the way it was structured with a high level of corridor right-of-way development, and therefore high capital costs. At this stage it would not seem appropriate to totally eliminate the guided bus from further consideration based on this finding. Rather this alternative should be restructured with a lower level of subway development and then subjected to the full evaluation.

For the revised index none of the alternatives fall within UMTA's threshold if a local match percentage is not considered. However, with a 30 percent local match all of the Light Rail Alternatives 3C, 3D, 3E, and 3F, and the Mini Metro Alternative 5D fall within the threshold for consideration in an Alternatives Analysis. If the local match is increased to 50 percent this situation improves. With up to a local match of 50 percent the Guided Bus Alternative still fails to fall below the threshold of $12.00 per hour of travel time saved. The poor performance of the Guided Bus Alternative is again the result of the assumed high level of corridor right-of-way development, and therefore high capital costs. At this stage it would not seem appropriate to totally eliminate the guided bus from further consideration based on this finding. Rather this alternative should be restructured with a lower level of subway development and then subjected to the full evaluation.

From the results of the cost effectiveness analysis it would appear that refined versions of the light rail, mini metro and guided bus alternatives are worthy of further analysis.

TABLE IX-11

Summary Cost Effectiveness Measures

	Alternatives					
Cost Effectiveness Index	3C	3D	3E	3F	5D	6
Total Standard	$3.78	$4.18	$4.26	$3.65	$4.39	$19.22
Total Revised	$16.35	$18.09	$16.12	$15.16	$18.55	$25.31
30% Local Match Standard	$2.03	$2.18	$2.35	$1.82	$2.43	$11.85
30% Local Match Revised	$10.11	$10.98	$10.43	$9.14	$11.57	$17.34
50% Local Match Standard	$0.86	$0.84	$1.08	$0.59	$1.12	$6.93
50% Local Match Revised	$5.95	$6.24	$6.64	$5.13	$6.92	$12.03

*3C = Core LTR (Ruggles to Community College)
3D = LRT (JFK/U Mass to Community College)
3E = LRT (JFK/U Mass to Airport via Community College)
3F = LRT (JFK/U Mass to Airport via Grand Junction Railroad)
5D = Mini Metro (Ruggles to Community College)
6 = Guided Bus

X. CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the conclusions and recommendations of the Circumferential Transit Feasibility Study. While earlier studies have identified the desirability of circumferential transit services, this effort has been the first to provide in depth information on the costs and benefits of alternative corridor improvements. In addition, this study provides a unique, comprehensive look at the entire MBTA transit system in the year 2010, both with and without circumferential corridor improvements. The findings of this study should be invaluable in reaching decisions about circumferential corridor improvements, as well as decisions regarding other regional transit needs.

The findings and recommended actions which follow are presented under four categories related to general conclusions, short term bus service improvements, short and mid range low cost traffic improvements, and high cost long range corridor investments.

A. GENERAL

The findings of the analysis of existing corridor conditions and the forecast of future year 2010 conditions demonstrate the need for significant transit improvements in the corridor over the coming years. Actions need to be taken immediately to improve existing bus operations, preserve options for future corridor development, help shape corridor land use to assure a transit orientation, and take advantage of development potential in the corridor to help off-set the cost of future corridor investments.

Given levels of existing development, transit ridership, and traffic congestion actions are needed immediately to improve existing bus services and bus operations at key locations in the corridor. The Longwood area, Boston University area, Kendall Square and the Charlestown Navy Yard are the most important of the areas deserving attention over roughly the next five years.

Development now underway and planned in the corridor, along with growth elsewhere in the region, make it clear that a major capital investment in the corridor will be desireable sometime after the year 2000. Without such an investment serious traffic problems and the potential overloading of the central segments of both the Green and Red Lines may result. Because of the long lead times involved in developing a new rapid transit line, planning for the Circumferential Line should be continued with the initiation of a more detailed study of alternatives, environmental impacts and funding alternatives. This planning effort also should focus on identifying those right-of-way opportunities most worthy of preservation and the identification of ways in which new development can both physically and financially support the ultimate construction of the Circumferential Line.

Finally, the study has identified a number of significant data needs regarding the current and future MBTA transit system. These include better information on the volume and origin and destination pattern of existing users of both the bus and rail systems. While conducting a system-wide origin and destination survey would be highly valuable for future planning, the costs and disruption of such a survey may be prohibitive. Short of such an undertaking the MBTA should embark on a regular program of monitoring ridership. Ideally, the following data should be collected on an annual basis:

- Boarding and alighting counts should be taken on all bus routes in the system at least once a year. These counts could be made by on-board monitors who "rove" throughout the system. This information should be used to develop a route by route review mechanism to monitor ridership changes in the system and provide information for on-going service planning. While recent bus corridor studies provide some data on ridership, information is incomplete and inconsistent among the various studies. Thus, it was very difficult to analyze current bus travel patterns in the circumferential corridor since the corridor cuts across a number of the bus corridor study areas.

- Boarding and alighting counts should be taken at all stations and stops on the rapid transit system and the Green Line Branches at least once a year. While limited turnstile count data is available for station boardings, the practice of "pass flashing" limits the accuracy of these numbers. Little or no data is available on station alightings. Counts need to be done throughout the day to provide more accurate line by line peaking factors, as well as volume totals

- Consideration should be given to limited origin and destination (O&D) studies on some portions of the system. For future circumferential corridor analysis, an O&D study of existing cross town bus services and the central portions of the Green Line would provide much valuable information.

B. SHORT TERM BUS IMPROVEMENTS

The study has identified a number of bus service improvements in the corridor that appear worthy of implementation over the next five years. These improvements are designed to meet both existing travel needs and those that are likely to develop in the coming years. In the case of the latter, the MBTA should monitor development and travel demand in a number of areas to determine the most appropriate timing of service additions. Areas requiring close attention include the Newmarket and Boston City Hospital areas in Boston; the University Park, Kendall Square and East Cambridge/Lechmere/North Point areas in Cambridge; and the Charlestown Navy Yard.

Specific bus route recommendations include the following:

1. **Route 8 & 46** - combining the Route 8, which connects Harbor Point to Ruggles Station, and the Route 46, which connects Dudley Square to South Huntington/Heath Street would form one route connecting Harbor Point to South Huntington/Heath Street, with access to the Orange Line at Jackson Square Station.

2. Route 63 - this route, which connects Cleveland Circle to Central Square Station in Cambridge should be extended to Kendall Square Station.

3. **Route 64** - this route, which connects Oak Square in Brighton to Central Square Station in Cambridge should be discontinued in combination with the Route 86 extension to Oak Square, discussed below.

4. **Route 65** - this route, which now connects Brighton Center to Kenmore Square, should have improved service levels with shortened headways and extended service hours.

5. **Route 70** - this route, which currently runs between Waltham and Central Square Station in Cambridge, should be extended to Kendall Square Station.

6. **Route 86** - this route, which connects Sullivan Station on the Orange Line to Harvard Square in Cambridge and Union Square in Allston should be extended to Oak Square in Brighton with the elimination of service on the Route 64 as discussed above.

7. **New Route 226** - the addition of this route would provide new service between Kenmore Square and Harvard Square via Commonwealth Avenue and the Boston University Bridge. This new route would reduce ridership on the existing Routes 1 and 47 and help reduce current overcrowding. Implementation of the new Route 226 should be considered following a review of the potential service and operating impacts on the Routes 1 and 47.

8. **New Route 229** - this new route would connect Ruggles Station on the Orange Line to the Charlestown Navy Yard, via the Longwood Medical Area, University Park/MIT, Kendall Square, Lechmere Station, and Community College Station on the Orange Line. Initial implementation of this route could be accomplished by modifications to the existing Routes 63 and 47-A, as follows:

   - **Route 63:** Extend the existing service from Cleveland Circle to Central Square Station in Cambridge and on to Kendall Square, Lechmere, Community College Station and the Charlestown Navy Yard.

   - **Route 47-A:** Extend the existing short trip from Boston City Hospital to Kenmore Square over the Massachusetts Avenue Bridge to MIT, then via Vasser and Main Streets to Kendall Square.

9. **Mass Turnpike Express Bus Routes** - four potential routes have been identified for improving express bus services from the western suburbs to the Longwood area, emerging growth centers along the Charles River in Cambridge, and possibly the Charlestown Navy Yard. While changes to the Turnpike in the vicinity of the existing Allston interchange are desireable to support these routes, all could be implemented as demand warrants prior to any modifications. Consideration should be given to the Longwood and Kendall Square routes in the near future. Service to the University Park/MIT, East Cambridge/Lechmere, and Charlestown Navy Yard areas should be considered as development in these areas warrants.

C. MODEST COST TRAFFIC IMPROVEMENTS

The Circumferential Transit Feasibility Study also has identified a number of modest cost traffic improvements capable of improving traffic flow and bus operations on existing streets and arterials in the corridor. Most of these improvements will require the MBTA to work closely with local municipalities and other State agencies to gain implementation and design sensitive to the needs of bus operations.

Specific recommendations include the following:

1. **Newmarket Area** - the MBTA should work closely with the Boston EDIC and the Boston Transportation Department to gain improvements to Massachusetts Avenue supportive of bus service improvements through this redevelopment area.

2. **South Bay Interchange** - the MBTA should work closely with the State DPW and the Boston Transportation Department to gain improvements in the area as part of the Central Artery reconstruction supportive of expanded bus service in the Melnea Cass Boulevard/Massachusetts Avenue corridor.

3. **Melnea Cass Boulevard** - the MBTA should monitor traffic conditions in the area to determine the appropriate timing for the development of the existing transit reservation as a bus facility. Consideration should also be given to the eventual conversion of the right-of-way for use by light rail or an aerial guideway for mini metro operation. Finally, and development along the corridor, including the addition of curb cuts, should be closely monitored to assure that bus operations will not be negatively impacted and that future development of the transit reservation is not compromised.

4. **Ruggles Station Area** - the MBTA should work closely with the Boston Transportation Department and the Boston Redevelopment Authority to implement the series of improvements identified in the body of this report to improve bus operations through Ruggles Station. Development should be monitored to assure that the existing easement through the station and the adjoining development parcels is maintained for possible future light rail or mini metro development.

5. **Ruggles Street** - Ruggles Street should be widened to a four lane cross section between Ruggles Station and Huntington Avenue. The existing transit reservation should be maintained with a minimum width of 32 feet. New development, including additional curb cuts, should be closely monitored to assure that future development of either a light rail line or mini metro tunnel is not impeded. In addition consideration should be given to the possibility that this segmentwill include a tunnel portal for the transition of a light rail line from surface to subway.

6. **Greater Longwood Area** - the MBTA should work with the City of Boston, MASCO and the Metropolitan District Commission (MDC) in the implementation of the series of recommended traffic improvements in the overall area from Huntington Avenue to the Boston University Bridge.

7. **Allston Interchange of the Mass Turnpike** - the MBTA should work with the Turnpike Authority and the Executive Office of Transportation and Construction to gain possible changes allowing bus use of the truck route now under study. This facility could allow express buses to exit the Turnpike and use the Grand Junction Bridge to reach destinations in Cambridge.

8. **University Park** - the MBTA should work with the City of Cambridge to gain improvements for the operation of buses in the University Park/MIT area as part of the proposed street changes in the area.

9. **Kendall Square** - the MBTA should work with the City of Cambridge and the Cambridge Redevelopment Authority to gain improvements for bus operations in the general area.

10. **Lechmere Station** - the design of the new station should provide for the smooth movement of buses between Kendall Square and Community College Station on the Orange Line and the Charlestown Navy Yard.

11. **Gilmore Bridge** - the MBTA should work with the Cities of Boston and Cambridge and the State DPW in a study to determine appropriate traffic flow improvements in the general area.

12. **Charlestown Navy Yard** - the MBTA should work with the City of Boston, the National Park Service and the New England Aquarium to gain the identified improvements needed to allow for

the smooth operation of buses through the Charlestown Navy Yard.

D. LONG RANGE IMPROVEMENTS

The results of the feasibility evaluation of the long range alternatives, indicate that at this level of analysis a number of options appear to provide highly cost effective solutions to meet corridor travel needs. In general, it is clear that without a major investment in the corridor, traffic conditions and transit operations will deteriorate significantly by the year 2010. In addition, growth in emerging activity centers in both Boston and Cambridge will be restrained without a major investment in the corridor. In addition, if the Circumferential Line is not built by the year 2010 costly improvements may be necessary to deal with capacity problems on key links of both the Red and Green Lines. Finally, opportunities exist both for transit line right-of-way and for the shaping of new development if planning for a Circumferential Line proceeds in a timely manner.

Investment in a major transit facility in the circumferential corridor will require a number of additional steps and actions. Should decisions be made to proceed, more in depth community involvement must be undertaken; refinement and more in depth analysis of corridor alternatives must occur; further study of land use and environmental issues will be required; actions must be taken to preserve existing right-of-way, and opportunities should be pursued to secure funding and joint development possibilities. The most important next step is to begin a formal Alternatives Analysis and Environmental Impact Statement process.

1. Technology Alternatives

The results of the long range alternatives evaluation indicate that both the light rail and mini metro technologies appear promising and are worthy of further study.

While the light rail options analyzed produced the lowest cost effectiveness ratios, the mini metro option is nearly as attractive. In addition, the mini metro alternative has a number of advantages. It produces the shortest travel times, would be fully accessible to special needs users, and results in lower operating costs per passenger compared to the light rail alternatives. On the negative side, it has a higher capital cost, would introduce a new technology to the MBTA system, and would not be as easy to implement in phases as compared to the other alternatives.

A distinct advantage of the light rail alternatives are their ability to operate on lower cost, non-grade separated right-of-way outside the core alignment. This is very important if the extensions from Ruggles to JFK/U Mass or northward from Community College are seriously considered. With light rail both extensions could be developed primarily at-grade within existing street and railroad rights-of-way. If these same extensions were developed using mini metro technology expensive aerial structure or subway construction would be required.

The guided bus option produced cost effectiveness measures much higher than those for any of the other alternatives. This is primarily a result of the high costs of right-of-way development and the lower ridership. The former occurred because of the extensive subway segments included in the feasibility study. The guided bus, however has significant advantages related to Circumferential Line phasing and its impact on reducing Green Line volumes. As a result, it is recommended that the cost and ridership impacts of a more modest approach be explored. One option would be to limit subway development to only the segment between Huntington Avenue and the Charles River. The crossing of the Charles might be accomplished by expansion of the existing rail bridge. Once in Cambridge the line would operate on existing and new streets from the river to the new Lechmere Station. From Lechmere it would utilize a [illegible] bridge to Community College Station and then a combination of aerial and surface guideway [illegible] Logan Airport.

2. Alignment Alternatives

While the feasibility study has analyzed a [illegible] number of potential routing options, both within [illegible] core corridor and extensions to the north and south [illegible] these are by no means optimal and should [illegible] subjected to further more detailed analysis [illegible] addition, a number alternative alignments [illegible] suggested during the study but not analyzed [illegible] result, it is recommended that the Alternatives Analysis process examine the following additional options in the core portion of the corridor:

- **Longwood to Kenmore Square** - alignments examined to date have been limited to [illegible] optional subway links running from [illegible] Longwood area to the Boston University Bridge. However, this alignment requires [illegible]

stations on the Circumferential Line and a new station on the C Branch of the Green Line. An alternative alignment down Brookline Avenue from Longwood Avenue to Kenmore Square might allow the B, C and D Lines to be intercepted at a single point, provide service to other major trip generators in the area, and result in a more logical alignment to reach the first station on the Cambridge side of the Charles River. If construction of this segment were accomplished by deep bore tunneling it should not seriously disrupt this congested area. Disadvantages of this option include, the difficulty of building a new station beneath the existing Kenmore Square Station, the loss of service to the center of the Boston University campus, and the difficulty of providing an interface with the Framingham Branch commuter rail service.

- **Kenmore Square to MIT** - The Charles River crossing near the Boston University Bridge results in an alignment through Cambridgeport without a station until Massachusetts Avenue. If the Longwood to Kenmore Square alignment were chosen a crossing of the Charles near the Massachusetts Avenue Bridge would be possible. This would provide a shorter, more direct routing to the first station in Cambridge.

- **University Park Options** - The analysis to date indicates that a subway alignment through this segment of Cambridge will probably be required. While use of the Grand Junction right-of-way might allow cut and cover construction, the appeal of this alignment was based initially on its use for at-grade light rail or guided bus operation. Since this now appears unlikely, it is recommended that alternative parallel routings be explored before a final alignment decision is made.

- **Grand Junction Railroad** - The use of the Grand Junction right-of-way in Cambridge beyond Broadway has appeal because of its width and relatively low development costs for surface light rail or guided bus. However, it does not appear possible to provide an attractive interface with the Red Line, unless the Circumferential Line is brought through Kendall Square. Since a Red Line connection is one of the most important in the system, it is recommended that further analysis of the Grand Junction alignment between Broadway and Sullivan Square be dropped.

- **Kendall Square to Lechmere** - Three alignments were explored for this segment, either all in subway or a combination of subway and surface. Further study of the options in this area is recommended recognizing the evolving development plans in the area.

- **Community College Station to the Charlestown Navy Yard** - Consideration of this segment was dropped early in the feasibility study because of the limited available right-of-way and low ridership. Since this decision was made, however, development plans in the Navy Yard have changed, a proposal to relocate the New England Aquarium to Drydock #2 has surfaced and the design of the new Central Artery crossings of the Charles River have progressed. In light of these events, it is recommended that this decision be re-examined.

Outside the core corridor both the JFK/U Mass and the Sullivan Square/Everett/Chelsea/Logan Airport extensions appear promising in the long term. However, alignments for these options were not subjected to the same detailed analysis as those in the core and deserve more detailed study in the next phase.

Finally, consideration should be given to the possible extension of the corridor from the vicinity of Boston City Hospital along Albany Street to the South Boston Piers area. This should be examined in light of recommendations forthcoming from the South Boston Piers Transit Study.

3. Right-of-Way Preservation

A number of right-of-way opportunities currently exist in the corridor. Some are under the control of the MBTA, some are under the jurisdiction of other transportation agencies and private railroads, while others are totally in private ownership. Additional study of the corridor should emphasize the more precise identification of those opportunities requiring actions to preserve. At this stage of the feasibility study the following appear the most important:

- **Newmarket Area** - Redevelopment of Massachusetts Avenue through this area should provide for the eventual construction of an at-grade light rail line.

- **Melnea Cass Boulevard** - The existing transit reservation should be preserved for eventual development of either an at-grade or aerial transit facility

- **Ruggles Station Area** - The existing easement through both the station and the adjacent development parcels should be preserved for eventual development of either an at-grade or subway transit facility

- **Ruggles Street** - The existing transit reservation should be preserved for eventual development of either an at-grade or subway transit facility. A tunnel portal may also be needed in this area if one of the light rail alternatives is pursued.

- **Longwood Area** - Little or no right-of-way opportunities other than existing streets are available in this area. However, redevelopment may provide opportunities to gain easements for subway stations and/or station access points. One critical location appears to be the intersection of Longwood and Brookline Avenues. If the Massachusetts College of Art properties located here are redeveloped, actions should be taken to gain a subsurface tunnel easement to provide for a larger radius curve than is now possible.

- **Boston University Campus** - Little or no right-of-way exists in this area. However, redevelopment may provide opportunities to gain easements for subway stations and/or station access points.

- **Grand Junction Railroad** - Actions should be taken to preserve this right-of-way opportunity between the Charles River and Broadway in Cambridge.

- **Kendall Square to Lechmere** - undeveloped properties in the Kendall Square area present a number of opportunities for development of the connection from Kendall Square to Lechmere Station. The MBTA should work closely with the City of Cambridge and the Cambridge Redevelopment Authority to identify strategies to preserve these opportunities. A critical connection is the link from the proposed Circumferential Line Station near the junction of Broadway and Main Streets around the east side of the Badger Building.

- **Lechmere Station** - The relocation of the Green Line Station and development of the former station site should provide for the eventual construction of a subway line through both the sites of the old and new stations.

4. Land Use and Environmental Studies

As part of the Alternatives Analysis and Environmental Impact Statement process the MBTA should work with the effected jurisdictions, associations, and institutions to broaden the study of land use and environmental implications. The following should be included:

- **Neighborhood Level Analysis** - the effects of improved transit accessand the environmental impact of corridor development on tributary areas should be analyzed. This effort should include the detailed identification of the business districts, residential neighborhoods, and transitional areas which constitute the circumferential corridor. This is in contrast to reliance on the generalized areas identified at the line segment level that were used in the feasibility study. The analysis should include extensive mapping and inventories, and a projection of changes in circulation and land use patterns that could result from Circumferential Line development.

- **Linear Analysis** - the effects of alternative route alignments should beanalyzed in much more detail. The development potential generated by improved transit availability as well as constraints caused by environmental impacts should be identified and assessed.

- **Nodal Analysis** - detailed urban design studies of areas surroundingpotential station locations should be undertaken. This work should include an examination of modal interfaces, pedestrian and vehicular circulation routes, land use changes, and impact responses and development opportunities.

- **Joint Development Opportunities** - Given current and likely future redevelopment activities in the corridor significant joint development opportunities exist. Opportunities include the potential for integrating stations in new buildings, as well as shaping the pattern and organization of new development to facilitate transit access and use. Key locations include the Newmarket area, the Boston City Hospital area, the Southwest Corridor development parcels near Ruggles Station, the greater Northeastern and Longwood area, Boston University, University Park and MIT in Cambridge, Kendall Square, East Cambridge, Lechmere and the Bunker Hill Community College area of Charlestown. Studies should be undertaken to identify the most likely locations, development partners

and the most likely mechanisms for preserving options and eventual implementation. Urban design studies should also be undertaken to explore station access opportunities, vehicular and pedestrian circulation patterns, and district land use.

- **Future Visions** - since construction of the Circumferential Line is not likely before the next century, a visionary stance is needed which considers a long range view of possible future development scenarios and their transportation implications. Such a vision should consider the following scenarios:
  - Increased pressure for close-in city living could result from rising energy costs, growing aggravation with traffic congestion, and an expanding gap in suburban housing affordability.
  - Multi-functional city districts with living, working, and recreation opportunities in close proximity could reduce the need for the daily work commute.
  - Redevelopment of pockets of decay to productive use could shift centers of activity and concentrations of residential density. An example of such potential is the south Everett and Chelsea areas where declining industrial use offers the opportunity for affordable waterfront residential redevelopment along the Mystic River.
  - Major institutions which generate significant transit use could relocate to escape congestion and facilitate expansion on less expensive land. For example, the exodus of one or two key institutions from the Longwood Medical Area might cause a significant change in transit use.
  - Changed transportation patterns, such as remote airline boarding or airport relocation, would cause obvious shifts in transit system use.
  - Continued suburban urbanization and transformation to a multi-centered metropolitan area could lead to the growth of outer rings of concentric circumferential transit need with or without a corresponding reduction in demand for center city access.

5. Community Involvement

The public participation process to date has been conducted at a system wide level. While this is appropriate at the corridor feasibility stage, a more formal, area specific and interactive process involving neighborhood associations, individuals, major institutions, and local jurisdictions needs to take place. Participation should occur at all levels of further study beginning with the scoping and data gathering stages and proceeding through programmatic and conceptual studies to review and comment on final products as an integral element of their formal presentation.

6. Funding Options

The feasibility analysis indicates that development of a new Circumferential Line will be a costly undertaking. The least expensive minimum segment is estimated to require an investment approaching $1 Billion (1988). At the feasibility level no work has been undertaken to develop a funding program. However, a number of possibilities are apparent at the local, state and federal levels. Given that the major capital construction needs would not occur until the late 1990's or after the year 2000 it is very difficult to predict the availability of state and federal funds. The investment required is not out of line with past major undertakings of the MBTA such as the northwest extension of the Red Line and the Southwest Corridor project. In addition, significant opportunities for private participation exist as a result of the large amount of on-going development in the corridor. Through joint development, right-of-way easements, and/or cash contribution, private development might participate in the construction of the Circumferential Line.

7. Central Subway Analysis

While this feasibility study analyzed the implications for the capacities of the downtown segments of the rapid transit lines in the year 2010, the findings were inclusive. As a result, it appears that capacity problems may exist on portions of the Blue, Green and Red Lines by the year 2010. While it is clear that the Circumferential Line will reduce volumes on the key Green Line segment between Park and Boylston Stations, the magnitude of this reduction and implications for Green Line operations cannot be determined without additional runs of the CTPS model. Implications for the Red and Blue Lines are less clear. In the case of the Red Line the Circumferential Line may or may not reduce volumes. Again, new runs of the CTPS model

atest South Boston Piers network are needed. he case of the Blue Line, the Circumferential Line pears to have little or no impact.

s a result, additional work on this issue is commenced. The first step would be to reach ecisions on the most likely configuration for the alance of the year 2010 MBTA system. Key decisions include the configuration of the South Boston Piers transit link, whether the F Branch of the Green Line to Dudley Square should be included, whether the E Branch of the Green Line should be assumed to extend all the way to Arborway and whether the G Branch of the Green Line to Ball Square should be included. Once the radial system configuration is fixed the CTPS model, using the most recent calibration, should be run. Model runs should be conducted for at least four of the Circumferential Line options, including the TSM Alternative 2, the Core LRT Alternative 3C, the Core LRT with JFK/U Mass extension Alternative 3D and the full corridor from JFK/U Mass to Logan Airport Alternative 3E.

CROSSTOWN PLAN

NATIONAL INSTITUTES OF HEALTH

1990 AWARDS

NATIONAL RANK	INSTITUTION	AMOUNT
2	Brigham and Women's Hospital	66,830,636
3	Dana-Farber Cancer Center	43,758,469
4	Children's Hospital	27,610,956
7	Beth Israel Hospital	16,445,759
15	New England Deaconess Hospital	7,608,587
	TOTAL	162,254,407

FUTURE DEVELOPMENT SITES

BOSTON VISIONS COMPETITION

WEST BOYLSTON STREET

Visions

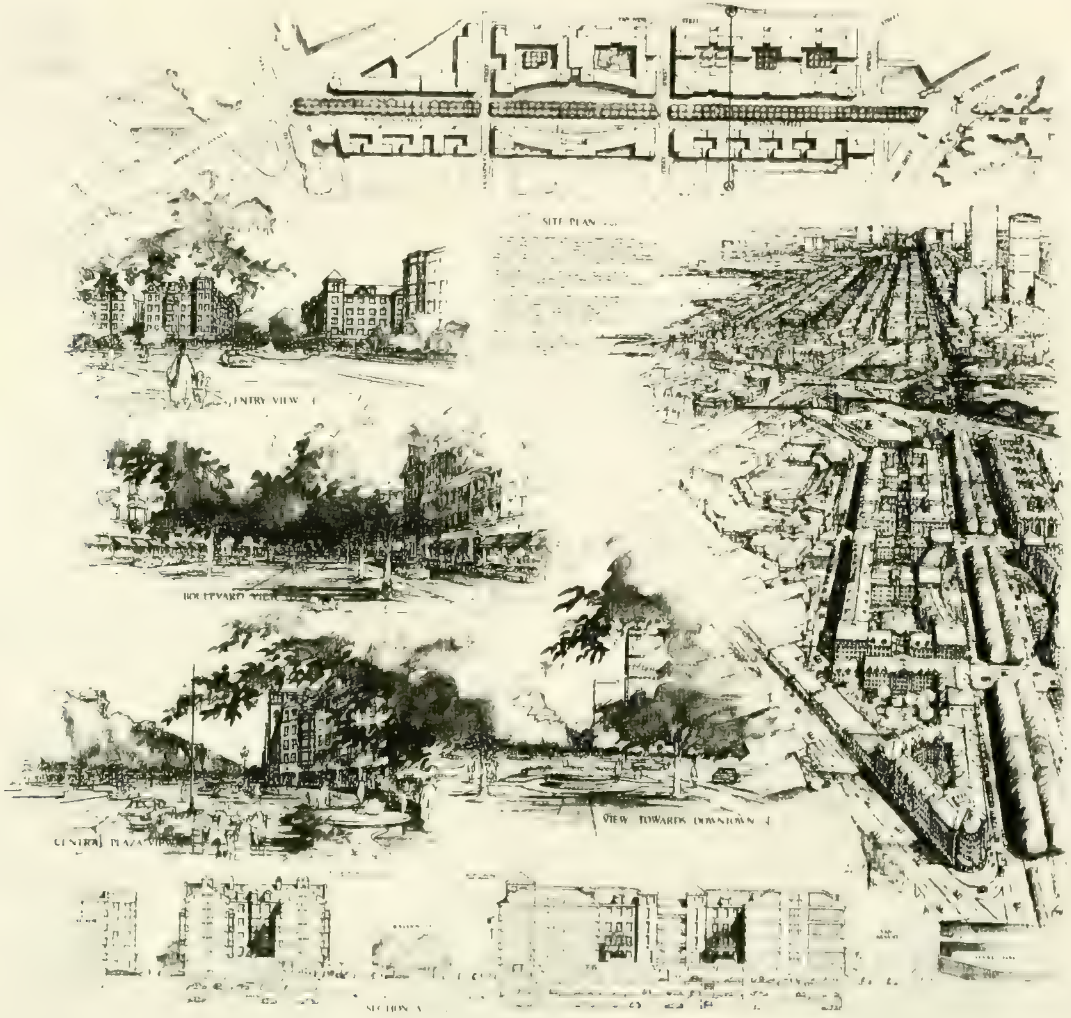
"Boylston Street Extension"

The creation of a new, landscaped boulevard in the tradition of Boston's Commonwealth Avenue would be a welcome addition to Boston's cityscape.

This proposal, beautifully and evocatively rendered, proposes a new boulevard of housing and ground-floor retail shops recalling Boston's Back Bay. By extending Boylston Street to connect two of Boston's open-space systems — the Fens and the Riverway — with landscaped open spaces of its own, it presents one possible solution for restoring some of the damaged links in Boston's Emerald Necklace.

What is even more appealing, this proposal is practicable and could be implemented incrementally.

First Award



Graham Gund Architects
Graham Gund FAIA
Dongik Lee
Kelly Monnahan
Sylvia Richards
David Perry AIA

Visions

"The Fens and Its Neighbors"

Through the formation of a series of new open spaces and boulevards, this proposal elegantly connects, both visually and functionally, the Fens to the Charles River Esplanade and Kenmore Square and integrates these connections into the surrounding fabric of neighborhoods. The result is a civic landscape of boulevards and places that provide the community with new meeting grounds and give new visibility, clarity, and access to the common spaces that already exist

First Award

Rothman Rothman

Jon Roll &

1907 BSA REPORT

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REPORT

MADE TO THE

Boston Society of Architects

BY ITS COMMITTEE ON

MUNICIPAL IMPROVEMENT

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THE BOSTON CHAMBER OF COMMERCE.
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THE suggestions offered herein are not endorsed, approved, or urged by the Boston Society of Architects or by any of the other associations who have joined in the expense of publishing this pamphlet. It is printed as an interesting study of subjects of public concern and in the hope that it may lead to fuller investigation by competent authorities into the subject of the municipal development of Boston.

Alfred Mudge & Son Inc. Printers
24 Franklin Street, Boston
1907

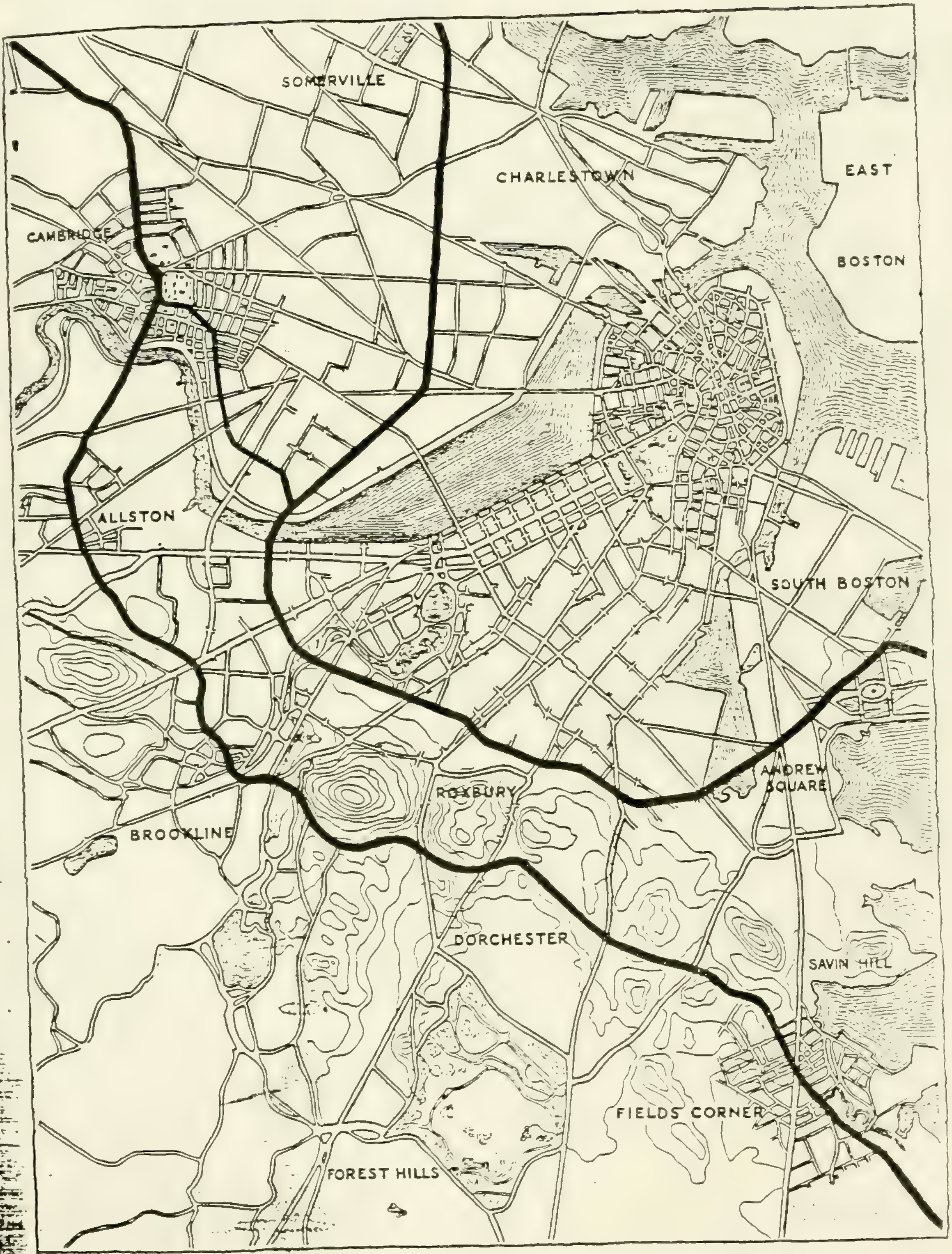

FIGURE 23.—Diagram Showing Location of Proposed Inner and Outer Boulevards.

[illegible]

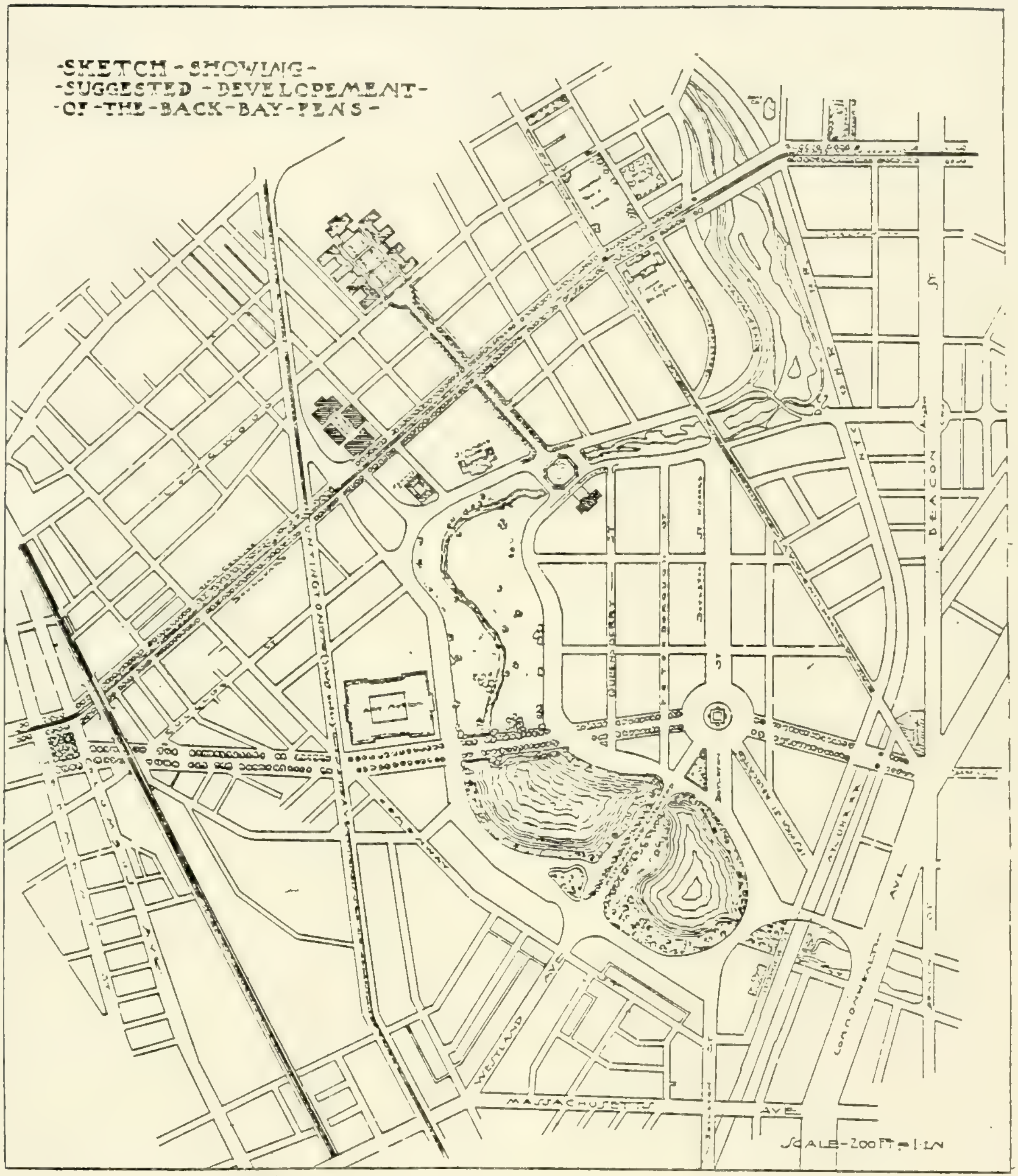

Figure 25. Proposed Streets in the Fenway Neighborhood.

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